User's Manual

Harmonic Measurement Software (IEC 61000-3-12 Compliant)

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Yokogawa Meters & Instruments Corporation

IM 761922-05E
4th Edition

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Thank you for purchasing the Harmonic Measurement Software (Model 761922).
This user's manual describes the handling precautions, functions, and operating procedures of the Harmonic Measurement Software within the Harmonic/Flicker Measurement Software. To ensure correct use, please read this manual thoroughly before beginning operation.
Keep this manual for quick reference in the event a question arises.
For information about the handling precautions, functions, and operating procedures of WT3000 Precision Power Analyzer and the Voltage Fluctuation and Flicker Measurement Software as well as the handling and operating procedures for Windows, see the manuals for those products.

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Notes about Using This Software

Storing the CD-ROM

Keep the original CD-ROM for this software in a safe place. To use this software, install it on a PC hard disk, and run it from the PC.

Using the Software

- Do not operate the WT while using this software. Doing so may cause errors.
- Disable the PC's standby mode. When a PC goes into standby mode, it may stop this software's operations.
- This software can only control one WT at a time. Also, it cannot connect multiple PCs to the same WT.
- If a connection error disrupts the connection between the WT and the PC, turn the WT OFF and then ON again.

How to Use This Manual

Structure of the Manual

This user's manual consists of the following sections.

Chapter	Title	Description
1	**Product Overrview**	Explains the software's features and the details of its applicable standards.
2	**Preparation before Use**	Explains how to connect the WT3000 to a PC and how to install this software.
3	**Starting and Using the Software**	Explains how to start the software and describes the main window.
4.	**Using the Start and Exit Pages**	Explains how to select a test schedule menu and how to close the software.
5	**Using the Open Page to Load Measured Data and Setting Information**	Explains how to load setting information and measured data.
6	**Using the Connection Page to Establish a Connection between the PC and a WT**	Explains how to establish a connection between the WT3000 and a PC.
7	**Using the Setting Page to Configure Measurement and Judgment Conditions**	Explains how to set general test conditions.
8	**Using the Measure Page to Make Measurementsa**	Explains how to execute a compliance test.
9	**Using the Analysis Page to Display Judgment Results and Measured Data**	Explains how to display judgment results and measured data.
10	**Using the Print Page to Print Reports**	Explains how to print a report.
11	**Using the Save Page to Save Setting Information and Measured Data**	Explains how to save setting information and measured data.
12	**Other Features**	Explains how to arrange windows, use the help function, and display the software's version information.
13	**Troubleshooting**	Lists various error messages.
14	**Specifications**	Lists the specifications of the software.
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Software Versions That This Manual Applies To

This manual applies to IEC 61000-3-12-compliant WT3000 Harmonic Measurement Software versions 5.01 or later. If you are using an older version, you will not be able to use all of the features described in this manual. The software version is displayed in the upper right of this software's window.

Correspondence with IEC61000-3-12

This manual mainly covers IEC61000-3-12 Edition 2.0. For explanations related to IEC61000-3-12 Edition 1.0, see followings.

CD: Manuals\English\761922\Manuals Old
File name: IEC61000-3-12 Users Manual xxx.pdf (xxx: Edition No.)

PC: Manuals\Old
File name: EN_IEC61000-3-12 Users Manual xxx Edition.pdf (xxx: Edition No.)

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1.1 Explanation of Functions

This software application (761922) measures the harmonics of electrical equipment according to the IEC Standard (see section 1.3 for an overview) and indicates/saves the results of judgments made according to the standard.

Applicable Measurement Instruments

This software can be used with YOKOGAWA's measurement instruments listed below. This user's manual (IM761922-05E) describes the case when this software is used in combination with the WT3000. For information about the handling precautions, functions, and operating procedures of the WT3000, see the respective manuals.

Product	Model
WT3000	760301, 760302, 760303, and 760304

Applicable Standard

For the applicable standards, see section 1.3.

Setting Up Test Schedule Menus

You can arrange the following steps as you like to create test schedule menus.

Start: Select and edit test schedule menus.

Open: Load measured data and WT setting information files.

Connection: Configure the connection between the PC and a WT.

Setting: Set compatibility and measurement conditions.

Measure: Measure voltage fluctuation and flicker.

Analysis: Display measured results as bar and trend graphs.

Print: Print screen images and reports.

Save: Save measured data and setting information files.

Exit: Close the software.

You can start this software and then operate it according to the order of one of the test schedule menus. By designing appropriate menus, you can make the testing process smoother. You can also avoid forgetting and skipping steps when you have to repeat the same process over and over again.
Here are more details about each step:

Start

Select and edit test schedule menus. There are four preset standard menus available in addition to custom menus that you can make yourself (located under the “User Setting” option button).

Open

Loading Setting Information

You can load setting information files that contain information such as the measurement mode, bar graph and list display formats, standard and measurement settings, the measurement time, and report titles and comments (reports contain information such as judgment results and lists and graphs of measured data values).

Loading Measured Data and Waveform Data

You can load the harmonic measurement data, waveform data, harmonic measurement conditions, and setting information that have been saved to a file.

Connection

Use to connect the PC on which this software is installed to a WT through a GP-IB or Ethernet interface.

Setting

Standard and Measurement Settings

You can set judgment conditions according to the IEC 61000-3-12 standard.

Setting the Measurement Time

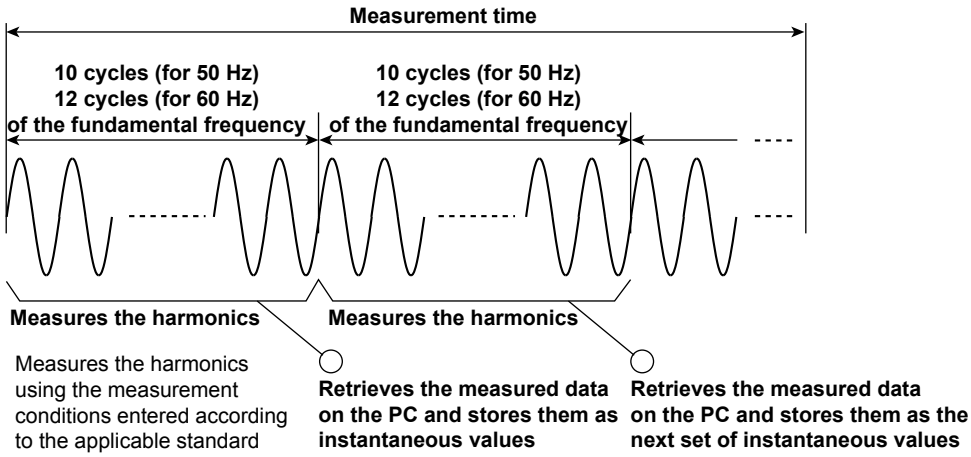
The measurement time is the time between the start of the measurement to the end of the measurement. The time for measuring harmonics is set in units of 1 s in advance. The harmonics can be measured continuously for the specified time. The measurement time can be changed when equipment that emits harmonics that fluctuate over time is measured or when confirming that the emitted harmonics do not change even when the equipment is operated over extended time.

Measure

There are three measurement modes that you can select from the Measure submenu: Compliance test, Harmonic preview, and Waveform preview. The software acquires different types of data and performs different operations for each measurement mode.

Compliance Test

- **When in On-Line Mode**
  Measurement and evaluation of harmonics conforming to “IEC 61000-3-12” can be made while making harmonic measurements on the WT

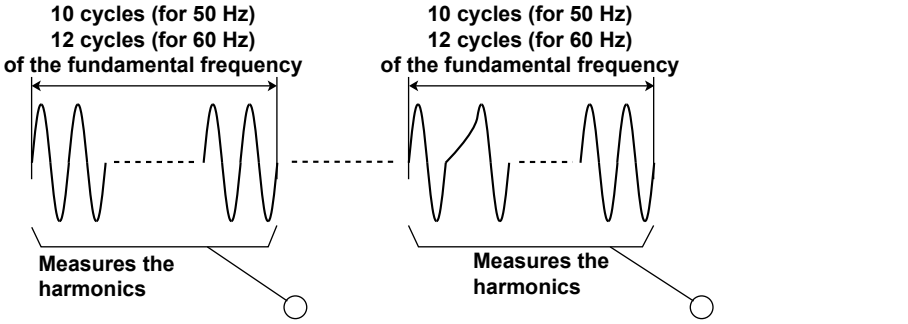


For IEC 61000-4-7 Edition 2.0 or Edition 2.0 A1, one set of harmonic measurement data (handled as instantaneous values by the software) consists of harmonic data measured every 200 ms (10 cycles for 50 Hz and 12 cycles for 60 Hz). The instantaneous values, the mean value, and the maximum value of the measured data retrieved within the measurement time (see next page) can be evaluated to determine whether they are within the limits of the standard.

- **When in Off-Line Mode**
  Evaluation can be made on the loaded measurement data according to the method complying with IEC 61000-3-12.

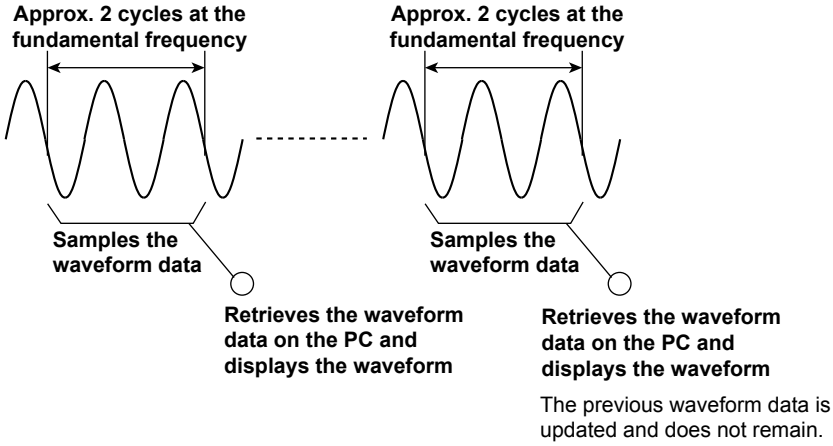
Harmonic Preview

You can only select Harmonic preview in online mode. As the WT measures the harmonic current, you can observe the harmonic fluctuations as they appear on a list of measured values. Unlike the compliance test, the harmonic preview is only for observing the state of a harmonic current. It does not determine whether or not a device conforms to certain standards. New data replaces old data. The software only retains the most recently acquired values.



Waveform Preview

You can only select Waveform preview in online mode. As the WT measures the harmonic current, you can observe the measured waveform. Unlike the compliance test, the waveform preview is only for observing the state of a waveform. It does not determine whether or not a device conforms to certain standards. New data replaces old data. The software only retains the most recently acquired waveform.



Starting/Stopping Measurements

Harmonic measurement on the WT can be started from your PC when in On-Line mode. The measurement cannot be started when in Off-Line mode.

- **Compliance Test**
  After you start WT harmonic current analysis from your PC, the PC will acquire and save the values that the WT measures. All of the data that is acquired during the specified measurement time is saved. After the specified measurement time is reached, the PC will automatically end measurement and data acquisition. You can also stop data acquisition from the PC before the measurement time is reached.

- **Harmonic Preview and Waveform Preview**
  After you start WT harmonic current analysis from your PC, the PC will acquire the values that the WT measures. New data replaces old data. The software only retains the most recently acquired data. Unlike the compliance test, the harmonic and waveform previews are only for observing the state of a harmonic current. They do not determine whether or not a device conforms to certain standards.

Analysis

The result of the evaluation as to whether the harmonic current data up to order 40 is within the limits of IEC 61000-3-12 and the corresponding measured data can be displayed. Various displays below are possible only when in harmonic measurement mode.

Display of the Evaluation Result within the Entire Measurement Time

Evaluation can be made as to whether all of the harmonic measurement data in the measurement time are within the limits according to the settings specified in “Setting the Standard and Measurement Environment” (as described earlier), and the results can be displayed collectively.

List and Bar Graph Displays of I_h/I_{ref}

The software displays the measured values of I_h/ I_{ref} and the standard limits of those values for each harmonic order in both a list and a bar graph. You can use colors to indicate whether a value is under its limit or not. The software judges based on the average, maximum, and instantaneous values that are acquired in a period of measurement (instantaneous values are the values that are acquired at each measurement of the harmonic current).

List and Bar Graph Displays of R_{sce}

The software displays the measured values of R_{sce} for each harmonic and the limits set by the standard for those values in both a list and a bar graph. You can use colors to indicate whether a value is under its limit or not. The software judges based on the average and maximum values that are acquired in a period of measurement.

Bar Graph Display of Harmonic Voltage, Current, and Phase Angle

You can display the measured data for each harmonic in a bar graph. The software will display the instantaneous values in the bar graph (instantaneous values are the values that are acquired at each measurement of the harmonic current).

List Display of Harmonic Voltage, Current, and Phase Angle

You can display the measured data for each harmonic in a list. The software will display the instantaneous values in the list (instantaneous values are the values that are acquired at each measurement of the harmonic current).

Trend Graph Display of Harmonic Measurements

For each harmonic, you can use a trend graph to show how the harmonic measurement data fluctuates over time.

Waveform Display of Voltage and Current

You can display a waveform that is measured immediately after the measurement time finishes. The software will display approximately two waveform periods. You can click on an area to display a cursor and show the instantaneous values there.

Print

To create reports, you can attach titles and comments to harmonic measurement data lists and bar graphs and then save them to .pdf or .bmp files or print them.

Save

Saving Setting Information

You can save setting information, such as measurement settings, measurement time, bar graph and list display formats, and report titles and comments, to an .ini file (reports contain information such as judgment results and lists and graphs of measured data values).

Saving Measured Data and Waveform Data

The software can save the measured data and waveform data that it acquires from the WT to an .fdt file. When the software saves this data, it will also save the WT harmonic measurement conditions along with the setting information described above to an .ini file.

Saving Measured Data and Waveform Data to CSV Format

You can use this software to save the harmonic measurement data and waveform data that the PC has acquired from the WT to a CSV file. This software cannot load CSV files, but you can use another program on the PC to load and view the CSV files that you save.

Exit

Use to close the software.

Online Mode and Offline Mode

Online Mode

The software is in online mode when the PC is connected to the WT through a GP-IB or Ethernet interface. The software must be in online mode to acquire harmonic data from the WT as the data is being measured. You can switch to Online mode from the Connection page. In online mode, you can change the WT settings from the PC.

Offline Mode

You can load previously saved harmonic measurement data into the software. You can change the settings and reanalyze the loaded data, and you can display a variety of lists and graphs.

1.2 PC System Requirements

PC

CPU
Pentium 4 1.5 GHz or higher (recommended)

Memory
1 GB or more (recommended)

Hard Disk
500 MB or more of free space

Operating System
Microsoft Windows XP, Windows Vista[*1], or Windows 7[*1].
*1 Both 32-bit versions and 64-bit versions are supported.

Communication Card
GP-IB
One of the following GPIB boards or cards by National Instruments.
You will need the driver version that is listed below for your OS or a later version (NI-488.2).

	PCI-GPIB	PCI-GPIB+	PCMCIA-GPIB	PCMCIA-GPIB+	GPIB-USB-HS
Windows XP	1.60[*2]	1.60[*2]	1.60[*2]	1.60[*2]	2.8.1
Windows Vista	2.7.2	2.7.2	not supported	not supported	2.8.1
Windows 7	2.7.2	2.7.2	not supported	not supported	2.8.1

*2 however, version 2.3 is not supported).

Ethernet
A 100BASE-TX Ethernet port.

Display, Printer, and Mouse
Must be compatible with the operating systems listed above.

WT3000
WT3000 firmware version 4.11 or higher with the following functions.
- Advanced calculation feature (/G6 option)
- GP-IB interface (standard) or Ethernet interface (/C7 option)

Correspondence between WT3000 Firmware Versions and IEC61000-4-7
If the WT3000 firmware version is 4.11 or later, you can select the IEC61000-4-7 edition number.
IEC61000-4-7 edition numbers
- Edition 1.0
- Edition 2.0
- Edition 2.0 A1

IEC61000-4-7 defines requirements for measurement instruments. For details, see chapter 14. If the WT3000 firmware version is between 4.01 and 4.10, the edition number is fixed to IEC61000-4-7 Edition 2.0.

Note
For information on updating the WT3000 firmware, contact your nearest YOKOGAWA dealer.

1.3 Applicable Standards

This software supports the following standards:

- The IEC 61000-3-12 Second Edition, and First Edition
- EN 61000-3-12 : 2011: 2005
- The IEC 61000-3-17 First Edition, Second Edition, and A1 of Second Edition

This section provides an overview of the standards. For more detailed information, please refer to the standards themselves.

Scope

The IEC 61000-3-12 First Edition harmonic current emission standard applies to electronic equipment that: (1) operates with single-phase 230-V 50-Hz or three-phase 400-V 50-Hz public low voltage power supply systems, and (2) has a rated input current that is above 16 A but not greater than 75 A.

Limits

IEC61000-3-12 Ed. 2.0

There are four types of limits:

- Limits for equipment other than balanced three-phase equipment
- Limits for balanced three-phase equipment
- Limits for balanced three-phase equipment under specified conditions (a, b, and c)
- Limits for balanced three-phase equipment under specified conditions (d, e, and f)

Limits for Equipment Other Than Balanced Three-Phase Equipment

Minimum Rsce	Admissible Individual Harmonic Current I_h/I_{ref}*[%]						Admissible Harmonic Current Distortion Factors [%]	
	I_3	I_5	I_7	I_9	I_{11}	I_{13}	THC/I_{ref}	PWHC/I_{ref}
33	21.6	10.7	7.2	3.8	3.1	2	23	23
66	24	13	8	5	4	3	26	26
120	27	15	10	6	5	4	30	30
250	35	20	13	9	8	6	40	40
≥350	41	24	15	12	10	8	47	47

The relative values of even harmonics up to order 12 must not exceed 16/n (%). Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd harmonics.

Linear interpolation between successive Rsce values is permitted.

* I_{ref} = reference current; I_h = harmonic current component

Limits for Balanced Three-Phase Equipment

Minimum Rsce	Admissible Individual Harmonic Current I_h/I_{ref}*[%]				Admissible Harmonic Current Distortion Factors [%]	
	I_5	I_7	I_{11}	I_{13}	THC/I_{ref}	PWHC/I_{ref}
33	10.7	7.2	3.1	2	13	22
66	14	9	5	3	16	25
120	19	12	7	4	22	26
250	31	20	12	7	37	38
≥350	40	25	15	10	48	46

The relative values of even harmonics up to order 12 must not exceed 16/n (%). Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd harmonics.

Linear interpolation between successive Rsce values is permitted.

* I_{ref} = reference current; I_h = harmonic current component

Limits for Balanced Three-Phase Equipment under Specified Conditions (a, b, and c)

Minimum Rsce	Admissible Individual Harmonic Current I_h/I_{ref}*[%]				Admissible Harmonic Current Distortion Factors [%]	
	I_5	I_7	I_{11}	I_{13}	THC/I_{ref}	PWHC/I_{ref}
33	10.7	7.2	3.1	2	13	22
≥ 120	40	25	15	10	48	46

The relative values of even harmonics up to order 12 must not exceed 16/n (%). Even harmonics above order 12 are taken into account in THC and PWHC in the same way as odd harmonics.

Linear interpolation between successive Rsce values is permitted.

* I_{ref} = reference current; I_h = harmonic current component

Limits for Balanced Three-Phase Equipment under Specified Conditions (d, e, and f)

Minimum Rsce	Admissible Individual Harmonic Current I_h/I_{ref}*[%]												Admissible Harmonic Current Distortion Factors [%]	
	I_5	I_7	I_{11}	I_{13}	I_{17}	I_{19}	I_{23}	I_{25}	I_{29}	I_{31}	I_{35}	I_{37}	THC/I_{ref}	PWHC/I_{ref}
33	10.7	7.2	3.1	2	2	1.5	1.5	1.5	1	1	1	1	13	22
≥ 120	25	17.3	12.1	10.7	8.4	7.8	6.8	6.5	5.4	5.2	4.9	4.7	35	70

If the Rsce value is equal to 33, the relative values of even harmonics up to order 12 must not exceed 16/n (%). The relative values of all harmonics between I14 and I40 that are not indicated in the above table must not exceed 1% of Iref.

If the Rsce value is equal to 250, the relative values of even harmonics up to order 12 must not exceed 16/n (%). The relative values of all harmonics between I14 and I40 that are not indicated in the above table must not exceed 3% of Iref.

Linear interpolation between both Rsce values is permitted.

* I_{ref} = reference current; I_h = harmonic current component

Note

The terminology used in the tables is that used in each edition of the standard.

IEC61000-3-12 Ed. 1.0

There are three types of limits:

- Limits for equipment other than balanced three-phase equipment
- Limits for balanced three-phase equipment
- Limits for balanced three-phase equipment under specified conditions

Limits for Equipment Other Than Balanced Three-Phase Equipment

Minimum R_{sce}	Admissible Individual Harmonic Current I_n/I_1[%]						Admissible Harmonic Current Distortion Factors[%]	
	I_3	I_5	I_7	I_9	I_{11}	I_{13}	THD	PWHD
33	21.6	10.7	7.2	3.8%	3.1	2	23	23
66	24	13	8	5	4	3	26	26
120	27	15	10	6	5	4	30	30
250	35	20	13	9	8	6	40	40
≥350	41	24	15	12	10	8	47	47

The relative values of even harmonics up to order 12 must not exceed 16/n (%).

Even harmonics above order 12 are included in THD and PWHD.

Note: Linear interpolation between successive R_{sce} values is permitted.

Limits for Balanced Three-Phase Equipment

Minimum R_{sce}	Admissible Individual Harmonic Current I_n/I_1[%]				Admissible Harmonic Current Distortion Factors[%]	
	I_5	I_7	I_{11}	I_{13}	THD	PWHD
33	10.7	7.2	3.1%	2	13	22
66	14	9	5	3	16	25
120	19	12	7	4	22	28
250	31	20	12	7	37	38
≥350	40	25	15	10	48	46

The relative values of even harmonics up to order 12 must not exceed 16/n (%).
Even harmonics above order 12 are included in THD and PWHD.
Note: Linear interpolation between successive R_{sce} values is permitted.

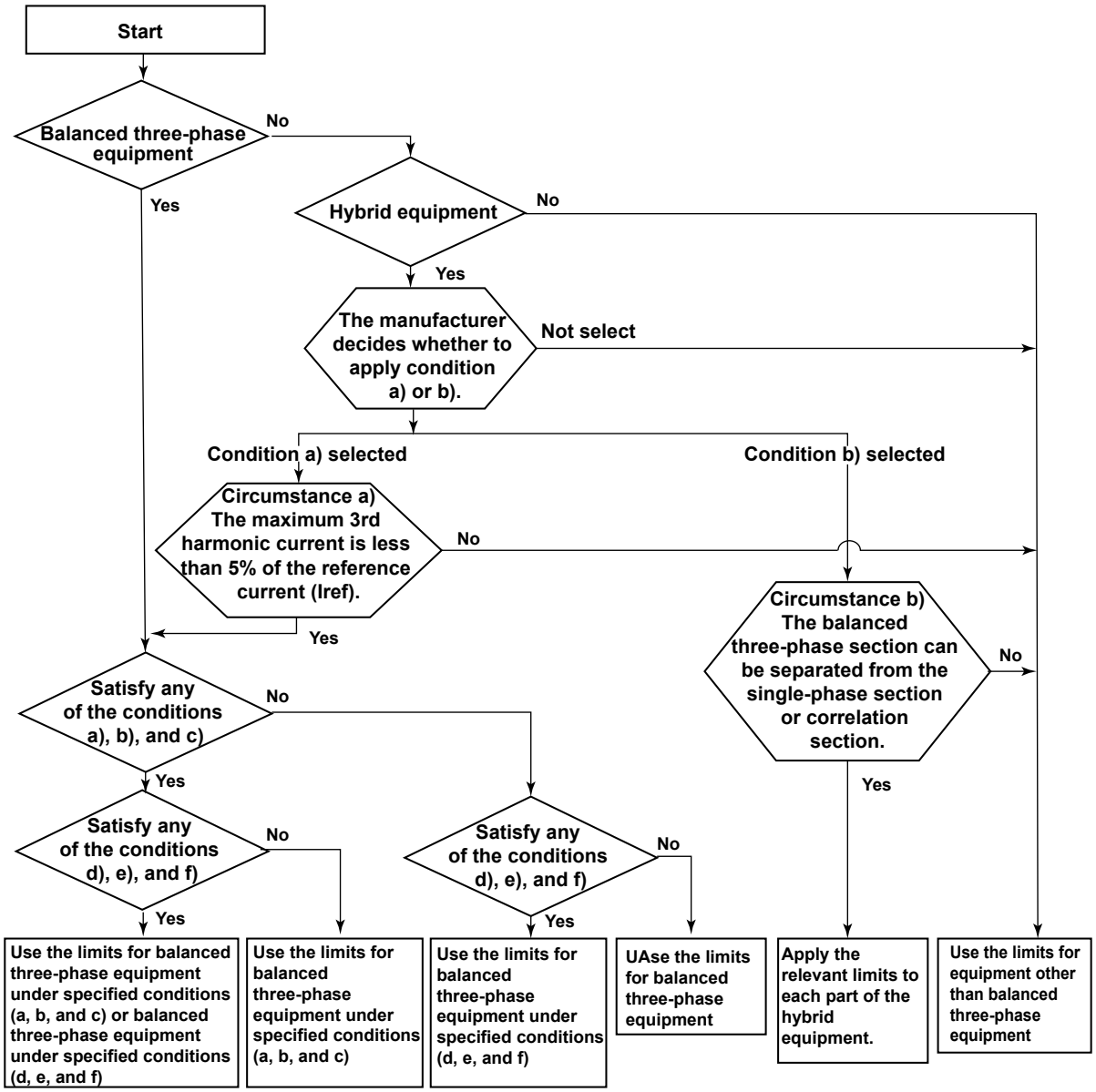
Limits for Balanced Three-Phase Equipment under Specified Conditions

Minimum R_{sce}	Admissible Individual Harmonic Current I_n/I_1				Admissible Harmonic Current Distortion Factors	
	I_5	I_7	I_{11}	I_{13}	THD	PWHD
33	10.7%	7.2%	3.1%	2%	13%	22%
≥120	40%	25%	15%	10%	48%	46%

The relative values of even harmonics up to order 12 must not exceed 16/n (%).
Even harmonics above order 12 are included in THD and PWHD.
Note: Linear interpolation between successive R_{sce} values is permitted.

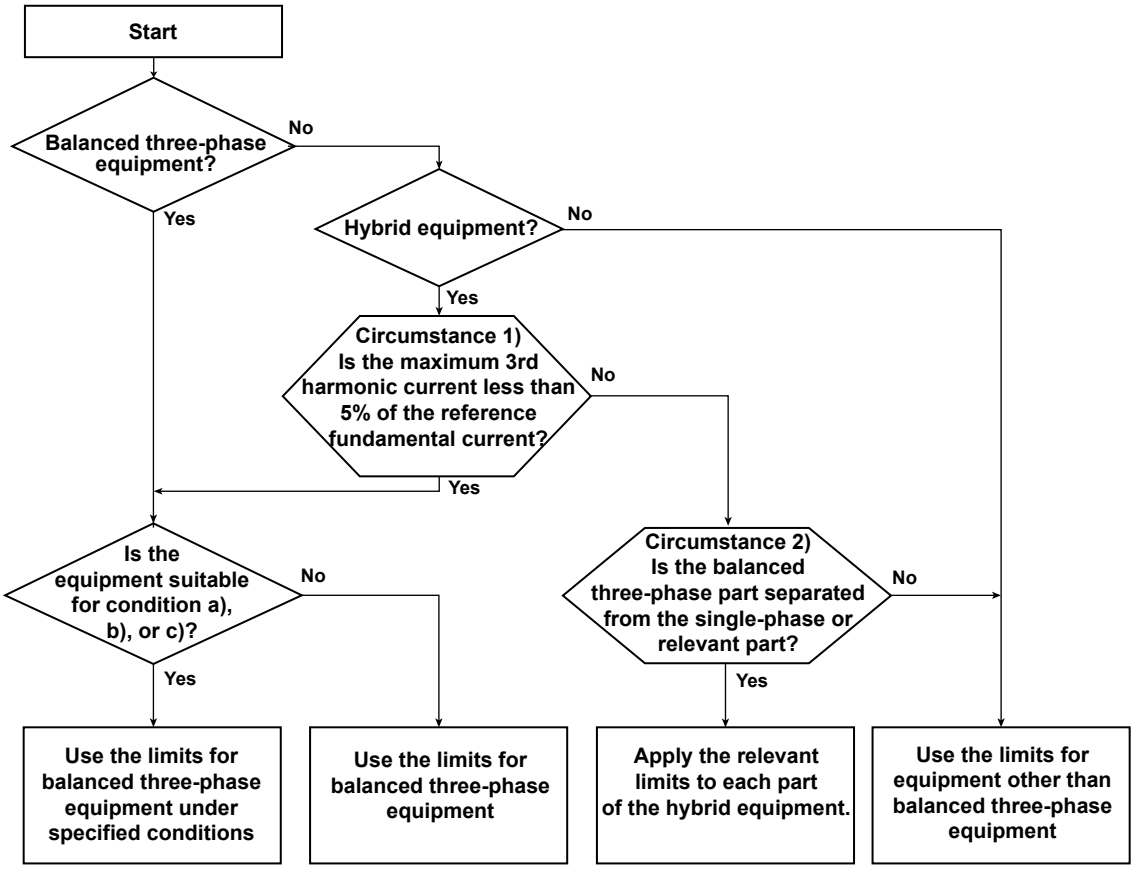
Flowchart for Applying the Limits to a Device

IEC61000-3-12 Ed. 2.0



*** When limits are applied automatically by this software, the limits for balanced three-phase equipment under specified conditions (d, e, and f) are used.**

IEC61000-3-12 Ed. 1.0



“Specified Conditions”

IEC61000-3-12 Ed. 2.0

There are six types of specified conditions:

a) The 5th and 7th harmonic currents are each less than 5% of the reference fundamental current during the whole observation period.

b) The equipment is designed such that the phase angle of the 5th harmonic current has no preferential value over time and can take any value from 0 to 360°.

c) The phase angle of the 5th harmonic current relative to the fundamental phase voltage is in the range of 90° to 150° during the whole observation period.

d) The 5th and 7th harmonic currents are each less than 3% of the reference fundamental current during the whole observation period.

e) The equipment is designed such that the phase angle of the 5th harmonic current has no preferential value over time and can take any value from 0 to 360°.

f) The phase angle of the 5th harmonic current relative to the fundamental phase voltage is in the range of 150° to 210° during the whole observation period.

IEC61000-3-12 Ed. 1.0

There are threeIEC61000-3-12 Ed. 1.0

There are six types of specified conditions: types of specified conditions:

a) The phase angle of the 5th harmonic current relative to the fundamental phase voltage is in the range of 90° to 150° during the whole observation period.

b) The equipment is designed such that the phase angle of the 5th harmonic current has no preferential value over time and can take any value from 0 to 360°.

c) The 5th and 7th harmonic currents are each less than 5% of the reference fundamental current during the whole observation period.

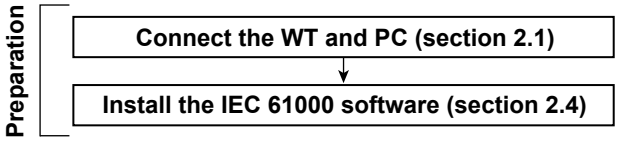
The WT3000 Window Function (Measurement Period)

The width of the window function (measurement period) for the measurements on the WT3000 is 200 ms (10 cycles at 50 Hz and 12 cycles at 60 Hz) as defined by IEC61000-4-7 Edition 2.0 or Edition 2.0 A1.

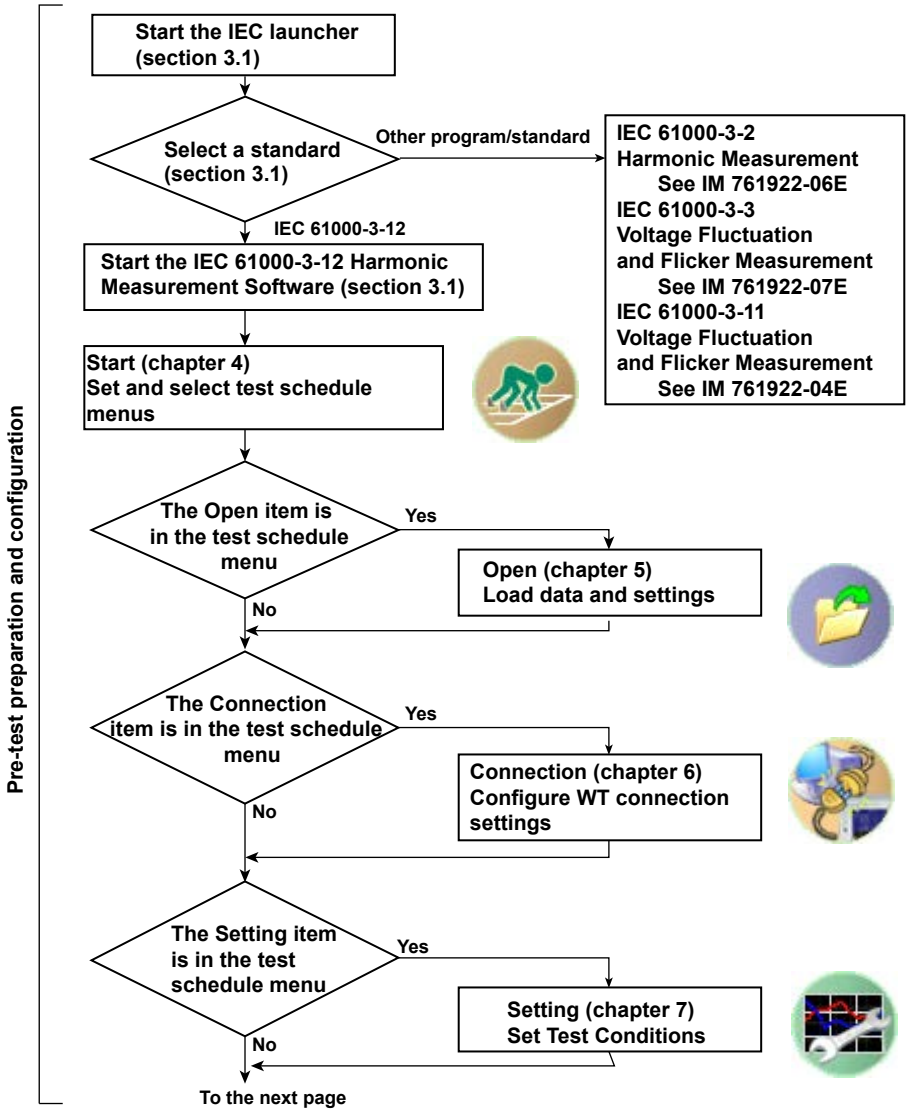
1.4 Flow of Operation

To display and judge harmonic measurement data using this software, the WT and PC must be connected, the software must be installed, WT measurement conditions must be set, and judgment conditions of the applicable standard must be set. Follow the steps below.
There are two methods for connecting the PC and the WT: GP-IB and Ethernet (WT3000 option).

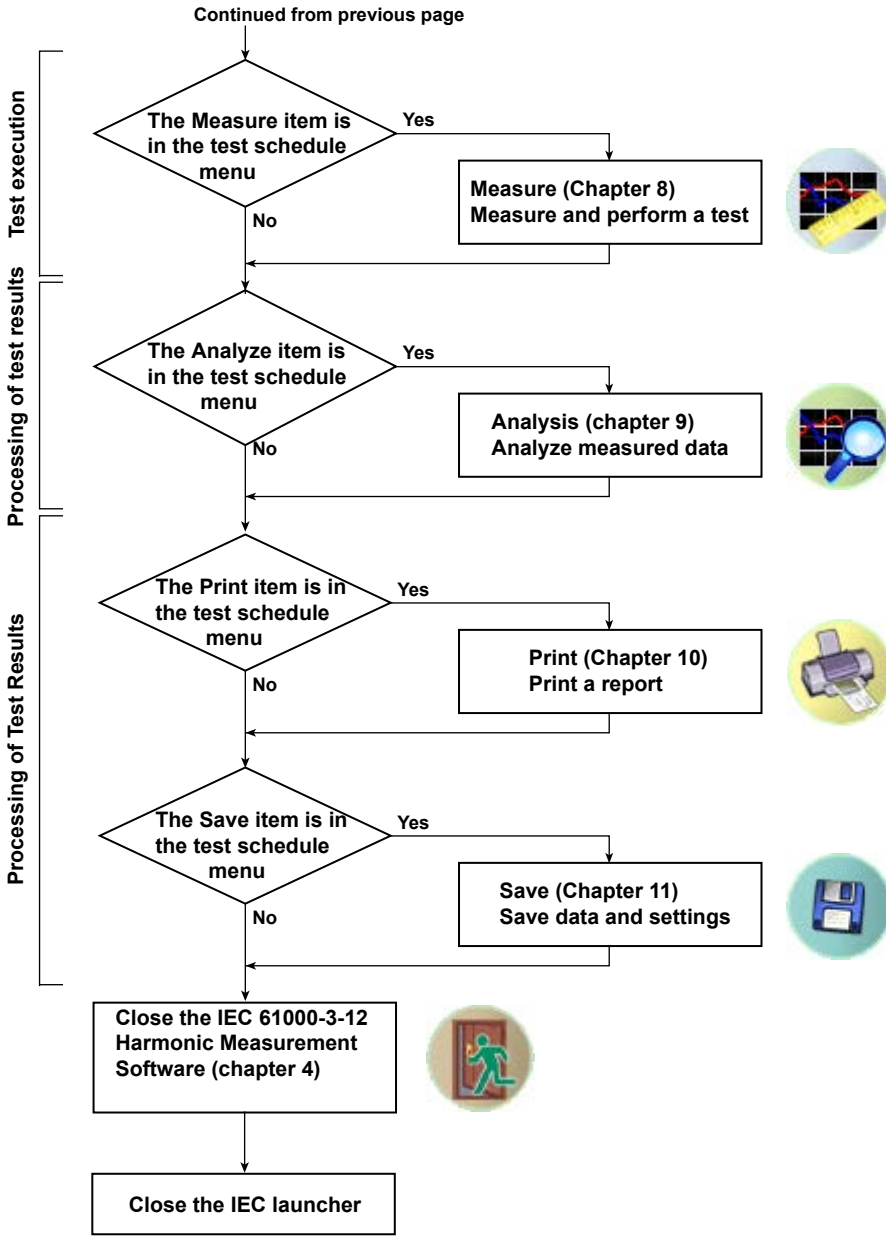
Preparation Flow Chart



Test Flowchart



* If you select IEC61000-3-12 Ed. 1.0, see the older edition of the instruction manual (ferer to page iv) for chapters 7 (configuration), 8 (test), and 9 (analysis).


Continued from previous page
Test execution
Processing of test results
Processing of Test Results
The Measure item is in the test schedule menu
Yes
No
Measure (Chapter 8)
Measure and perform a test
The Analyze item is in the test schedule menu
Yes
No
Analysis (chapter 9)
Analyze measured data
The Print item is in the test schedule menu
Yes
No
Print (Chapter 10)
Print a report
The Save item is in the test schedule menu
Yes
No
Save (Chapter 11)
Save data and settings
Close the IEC 61000-3-12 Harmonic Measurement Software (chapter 4)
Close the IEC launcher

1.5 Terminology Related to Harmonics

Harmonics refer to sine waves whose frequency is an integer multiple of the fundamental wave (normally sine waves of commercial frequency 50-Hz or 60-Hz) excluding the fundamental frequency.

Fundamental Wave (Fundamental Component)
The sine wave with the longest period among the different sine waves derived from the periodic complex wave. Or the sine wave that has the fundamental frequency within the components of the complex wave.

Fundamental Frequency
The frequency corresponding to the longest period in the periodic complex wave. The frequency of the fundamental wave.

Distorted Wave
A wave that differs from the fundamental wave.

Higher Harmonic
A sine wave with frequency that is an integer multiple (twice or greater) of the fundamental frequency.

Harmonic Component
Waveform component with frequency that is an integer multiple (twice or greater) of the fundamental frequency.

Harmonic Order
Integer ratio of the harmonic frequency with respect to the fundamental frequency. IEC defines the maximum harmonic order that is measured to be 40.

PLL Source
When measuring harmonics, the fundamental period (period of the fundamental signal) must be determined in order to analyze the higher orders. The PLL (Phase Locked Loop) source is the signal that is used to determine the fundamental period.

S_{sc} (Short Circuit Power)

$$\frac{U_{nominal}^2}{Z}$$

$U_{nominal}$: Systematic nominal line voltage
Z: System impedance of the power source frequency at the common connection point.

S_{equ} (Rated Apparent Power of the Equipment)
S_{equ} is calculated using one of the following formulas depending on the type of equipment.

a) $U_p\ I_{equ}$ Single-phase equipment and the single-phase components of composite equipment
b) $U_i\ I_{equ}$ Interphase equipment
c) $\sqrt{3} \cdot U_i\ I_{equ}$ Balanced three-phase equipment and the three-phase components of composite equipment
d) $\sqrt{3} \cdot U_i\ I_{equ}$ max(Ed2.0) Unbalanced three-phase equipment
$3 \cdot U_p\ I_{equ}$ max (Ed1.0)

U_p: Rated voltage (single phase)
U_i: Rated voltage (line)
I_{equ}:The manufacturer-specified rated line current of a device or one of its components
$I_{equ\ max}$: The maximum actual current value out of the three phases

R_{sce} (]short circuit ratio)

R_{sce} is calculated using one of the following formulas depending on the type of equipment.

a) $\frac{S_{sc}}{3 \cdot S_{equ}}$ Single-phase equipment and the single-phase components of composite equipment

b) $\frac{S_{sc}}{2 \cdot Sequ}$ Interphase equipment

c) $\frac{S_{sc}}{S_{equ}}$ Three-phase equipment and the three-phase components of composite equipment.

Terminology in IEC61000-3-12 Edition 2.0

THC (Total harmonic current) (Ed. 2.0)

The sum of the r.m.s values of harmonic current components from orders 2 to 40.

THC (Total Harmonic Component)

Sum (rs value) of harmonic currents of orders 2 to 40.

$$\sqrt{\sum_{h=2}^{40} Ih^2}$$

Ih: The rms current of each harmonic order
h: The harmonic order

PWHC (Partial Weighted Harmonic Current

$$\sqrt{\sum_{h=2}^{40} h \cdot Ih^2}$$

Ih: The rms current of each harmonic order
h: The harmonic order

Iref (reference current)

Equipment's r.m.s input current defined by the standard and used to determine the emission limits.

Terminology in IEC61000-3-12 Edition 1.0

THC (Total Harmonic Component) (Ed. 1.0)

Sum (rs value) of harmonic currents of orders 2 to 40.

$$\sqrt{\sum_{n=2}^{40} In^2}$$

In: The rms current of each harmonic order
n: The harmonic order

THD (Total Harmonic Distortion)

The ratio of the rms value of all harmonics of orders 2 to 40 and the rms value of the fundamental wave.

• V THD

$$\sqrt{\sum_{n=2}^{40}\left(\frac{U_n}{U_1}\right)^2} \times 100$$

• A THD

$$\sqrt{\sum_{n=2}^{40}\left(\frac{I_n}{I_1}\right)^2} \times 100$$

• P THD

$$\left|\frac{\sum_{n=2}^{40} P_n}{P_1}\right| \times 100$$

U_n: Rms voltage of each harmonic order
I_n: Rms current of each harmonic order
P_n: Active power of each harmonic order
n: Harmonic order
U_1: Rms value of the fundamental voltage waveform
I_1: Rms value of the fundamental current waveform
P_1: Active power of the fundamental waveform

PWHD (Partial Weighted Harmonic Distortion)

$$\sqrt{\sum_{n=14}^{40} n\left(\frac{In}{I1}\right)^2} \times 100$$

In: The rms current of each harmonic order
n: The harmonic order

I_1 (Reference Fundamental Current)

There are two ways to determine I_1:

- Measurement: Determine the average value of the fundamental current.
- Calculation: Use the following formula to calculate I_1.

$$\frac{I_{equ}}{\sqrt{1 + THD^2}}$$

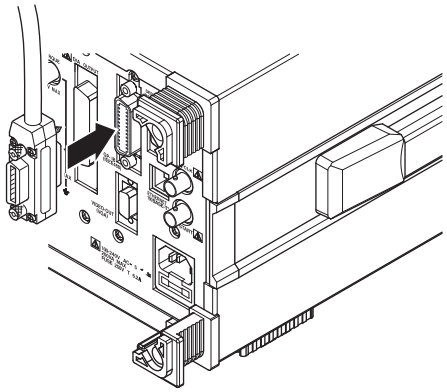
2.1 Connecting the WT3000 and the PC

CAUTION

When connecting or disconnecting communication cables, make sure to turn OFF the PC and the WT. Otherwise, erroneous operation or damage to the internal circuitry may result.

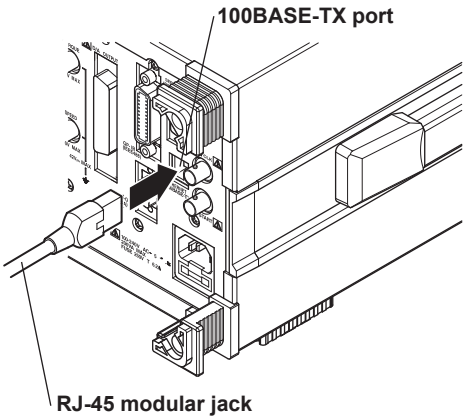
When Controlling the WT through the GP-IB

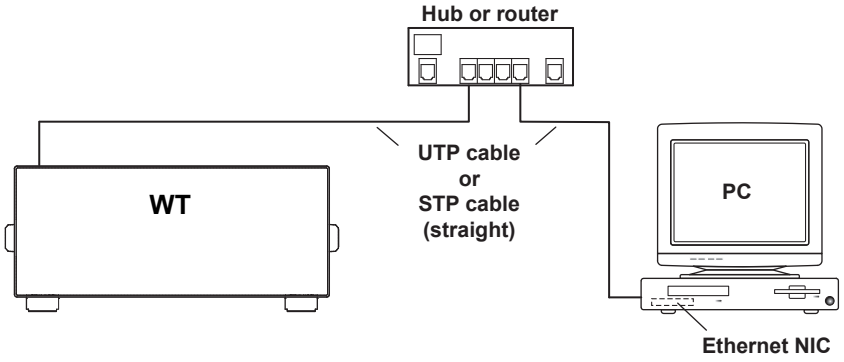
The GP-IB available on the WT is a 24-pin connector that conforms to the IEEE St'd 488-1978. Use a GP-IB cable that conforms to this standard. Connect the cable to the GP-IB connector on the rear panel of the WT. For details on the connection procedure and the specifications of the GP-IB interface, see the *WT3000 Communication Interface User's Manual IM760301-17E* on the CD-ROM. Use an appropriate connector for your PC to connect the other end of the GP-IB cable.



When Controlling the WT through the Ethernet Interface

Connect the WT and your PC through a hub using straight UTP (Unshielded Twisted-Pair) or STP (Shielded Twisted-Pair) cables. Connect the cable to the ETHERNET port on the rear panel of the WT. Use hubs, cables, and Ethernet NIC that are appropriate for the data rate. For details on the connection procedure and the specifications of the Ethernet interface, see the *Expansion Function User's Manual IM760301-51E* of the WT3000 and the *WT3000 Communication Interface User's Manual IM760301-17E* on the CD-ROM.





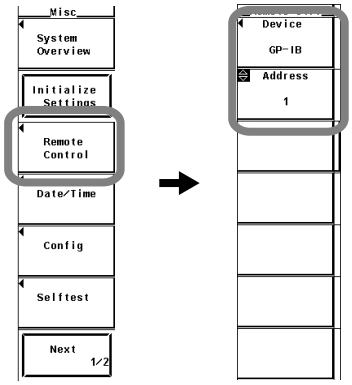
Note

- Use UTP (Unshielded Twisted-Pair) or STP (Shielded Twisted-Pair) cables of category 5 or better when connecting to a 100BASE-TX network.
- Do not directly connect the WT to the PC without using a hub. Operations are not guaranteed for communications using direct connection.

2.2 Setting the GP-IB Control

Procedure

1. Press **MISC** to display the Misc menu.
2. Press the **Remote Control** soft key to display the Remote Ctrl menu.
3. Press the **Device** soft key to select GP-IB.
   Only the communication interface selected here is enabled. The WT does not accept commands that are transmitted to other unselected communication interfaces.
4. Press the **cursor keys** to set the address.



Explanation

To use the software in On-Line mode through the GP-IB interface, operate the WT to select GP-IB.

Setting the Address

Set the WT address within the following range.
1 to 30

Each device that can be connected via GP-IB has a unique address within the GP-IB system. This address is used to distinguish the device from others. Therefore, make sure that the WT address does not overlap with other devices when connecting the WT to the PC.

Note

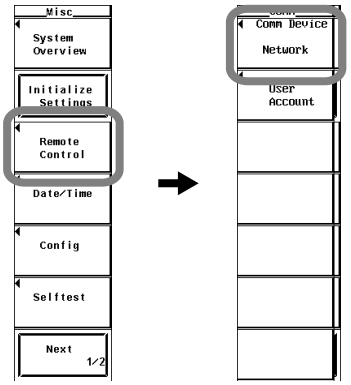
- Do not change the address while the controller (PC) or other devices are using the GP-IB system.
- When connecting the WT to a single PC and controlling the WT using this software, multiple communication interfaces cannot be used simultaneously.
- Use a GP-IB card by National Instruments on the PC end. For details, see section 1.2.
- The software may not operate correctly, if an adapter is inserted in the middle of the connection between the WT and the PC (for example, GP-IB-to-USB adapter). For details, contact your nearest YOKOGAWA dealer.

2.3 Setting the Ethernet Control

Procedure

Setting the Ethernet Interface

1. Press **MISC** to display the Misc menu.
2. Press the **Remote Control** soft key to display the Remote Ctrl menu.
3. Press the **Device** soft key to select Network.
   Only the communication interface selected here is enabled. The WT does not accept commands that are transmitted to other unselected communication interfaces.



Setting the User Name and Password

4. Press the **User Account** soft key to display the User Account dialog box.
5. Press the **cursor keys** to select User Name.
6. Press **SET** to display the keyboard.
7. Use the **keyboard** on the WT to enter the user name.
   For the keyboard operation of the WT, see the WT User's Manual.
8. Press the **cursor keys** to select Password.
9. Press **SET** to display the keyboard.
10. Use the **keyboard** on the WT to enter the password.
    Enter the password twice for confirmation.
    A password is not required if the login name is anonymous.
    For the keyboard operation of the WT, see the WT User's Manual.

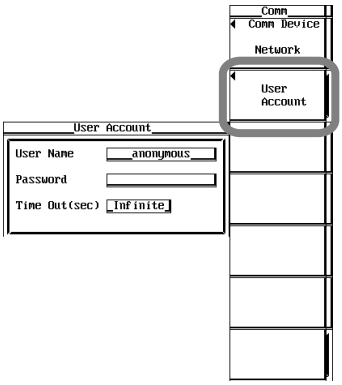
Setting the Timeout Value

11. Press the **cursor keys** to select Time Out.

12. Press **SET** to display the timeout time selection box.

13. Press the **cursor keys** to set the timeout value.

14. Press **SET** or **ESC** to close the box.



Setting TCP/IP

You must enter TCP/IP settings to control the WT from a PC through the network. For the setup procedure, see the *Expansion Function User's Manual IM760301-51E* of the WT3000.

Explanation

To use the software in On-Line mode through the network, operate the WT to select Network.

Setting the User Name

- Enter the user name to allow access to the WT.
- Enter up to 15 characters.
- The characters that can be used are 0-9, A-Z, %, _, ( ) (parentheses), - (minus sign).
- If you specify anonymous, the WT can be accessed from the PC without a password.

Setting the Password

- Enter the password of the user name to allow access to the WT.
- Enter up to 15 characters.
- The characters that can be used are 0-9, A-Z, %, _, ( ) (parentheses), - (minus sign).
- If you set the user name to anonymous, the WT can be accessed from the PC without a password.

Setting the Timeout Value

The WT closes the connection to the network if there is no access for a certain period of time (timeout value).
The available settings are 1 to 3600 s, or Infinite. The default value is Infinite.

Note

- To activate the settings, you must power cycle the WT.
- When connecting the WT to a single PC and controlling the WT using this software, multiple communication interfaces cannot be used simultaneously.
- The software may not operate correctly, if an adapter is inserted in the middle of the connection between the WT and the PC (for example, GP-IB-to-USB adapter). For details, contact your nearest YOKOGAWA dealer.

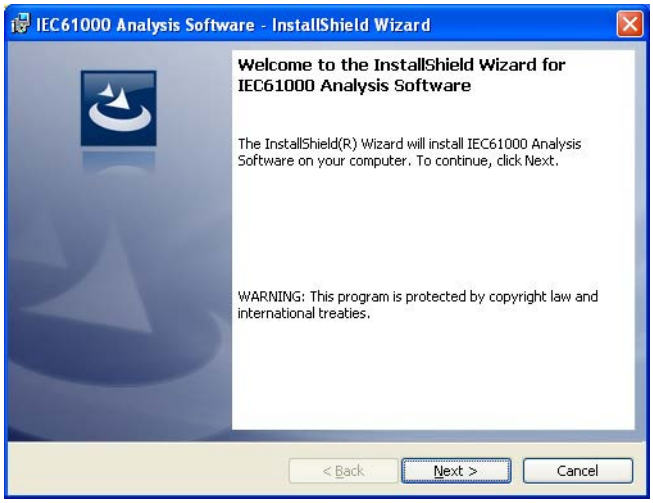
2.4 Installing the Software

Procedure

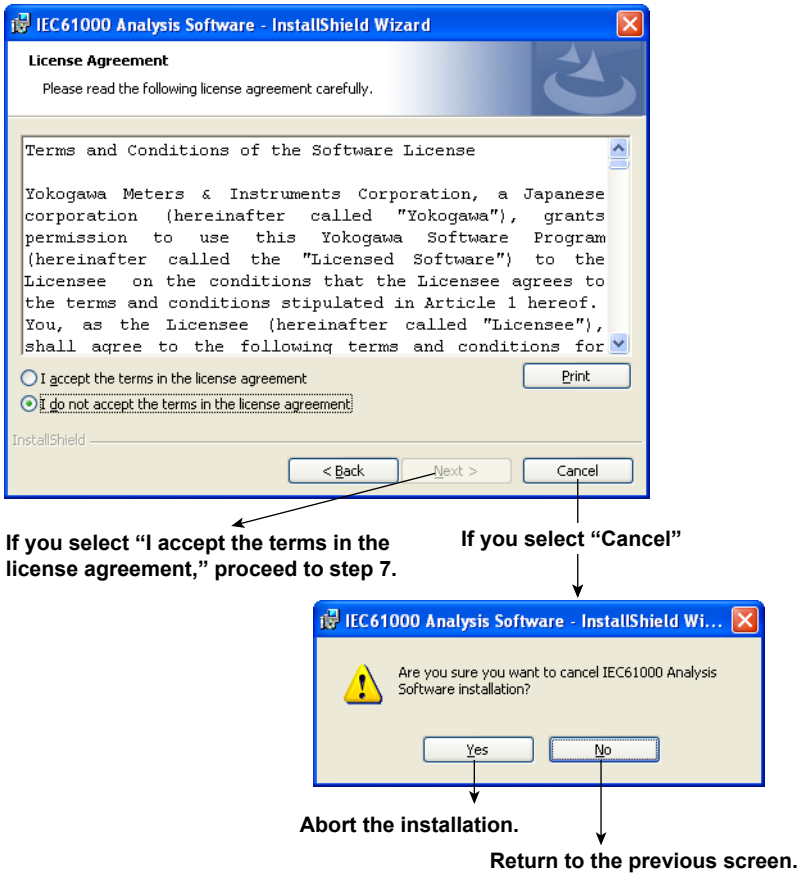
Have the CD-ROM containing the software ready. Exit all programs that are currently running before starting the installation. If an older version of the Harmonic/Flicker Measurement Software is installed, uninstall it first.
The following procedures are for installing the software on Windows XP. The screens shown in the figure may vary depending on the OS that is running on the PC.

1. Start Windows.
   Set the user name to Administrator when starting up.
2. Place the installation CD-ROM containing the software into the CD-ROM drive.
3. Double-click My Computer, then the CD-ROM icon.
4. Double-click **Setup.exe**. InstallShield Wizard starts.

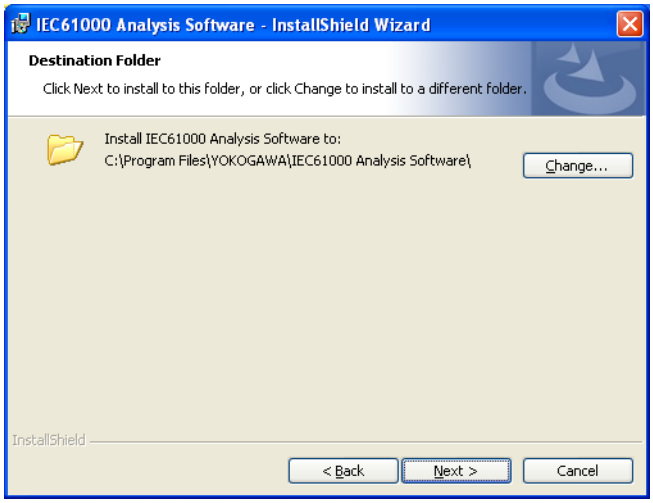
5. Click **Next**.



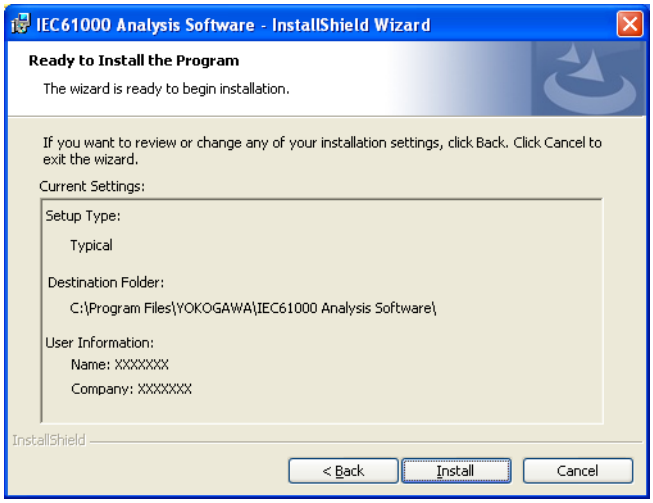
6. If you accept the terms of with the license agreement, select **"I accept the terms in the license agreement"**, and click **Next**. If you do not, select **Cancel**.



7. Select the installation destination, and click **Next**.
Click Change to specify the installation destination. The default installation destination is set to "C:¥Program Files¥Yokogawa¥IEC61000 Analysis Software."



8. Click **Install**. The installation starts.



9. If the PC's OS is Windows Vista or Windows 7, the User Account Control screen will appear part way through the installation. Click **Yes** to continue with the installation.

10. If the installation completes successfully, the following message is displayed. Click **Finish**.

The program icon (shortcut) of the software is added in the program menu of the Start menu. The program folder is Yokogawa.

Uninstalling the Software

The procedure below is for uninstalling the software program on Windows XP.

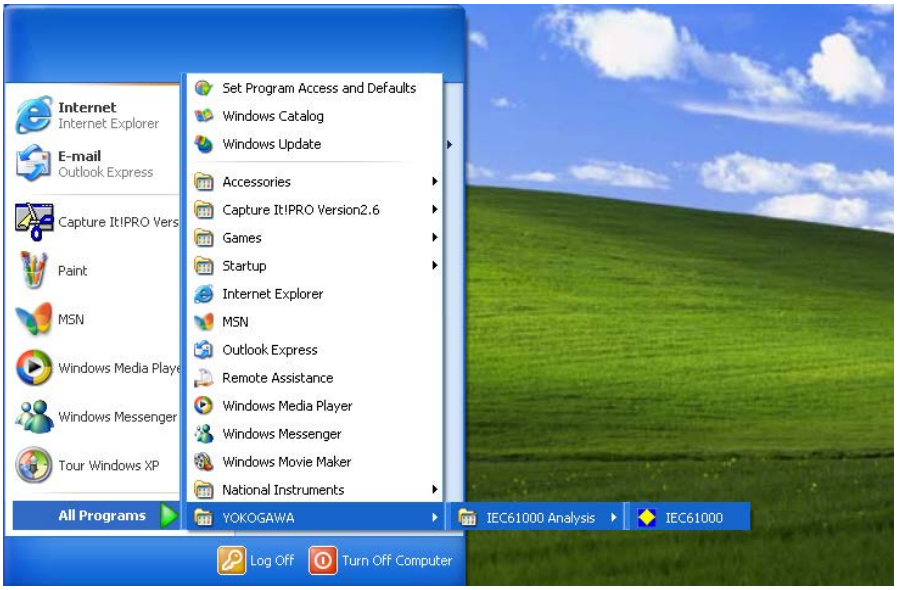
1. On the task bar, click the Start button and choose Control Panel.
2. Double-click **Add or Remove Programs** from the Control Panel.
3. Select **IEC61000 Analysis Software** in the Add or Remove Programs window and click **Remove**.
4. A confirmation dialog box for removing the program opens. Click **Yes** to delete the program. Clicking **No** will cancel the removal operation.
5. The software program is uninstalled.
6. If the PC's OS is Windows Vista or Windows 7, the User Account Control screen will appear part way through the uninstallation. Click **Yes** to continue with the uninstallation.

3.1 Starting the Software

Procedure

Starting the Software

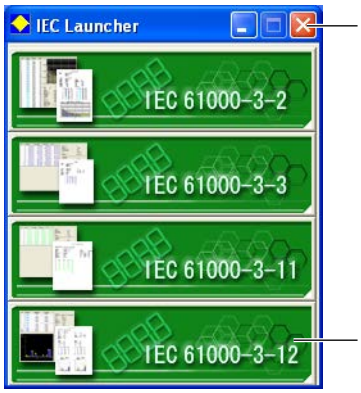
1. From the **Start** menu, choose **Programs** > **Yokogawa** > **IEC61000 Analysis** > **IEC61000**. The IEC 61000 software starts.
   The procedure above applies when the default software installation destination and program folder are used. If you changed the installation destination or program folder at installation, select the corresponding location.



After you start the software, the IEC Launcher appears. Use it to select the appropriate standard.

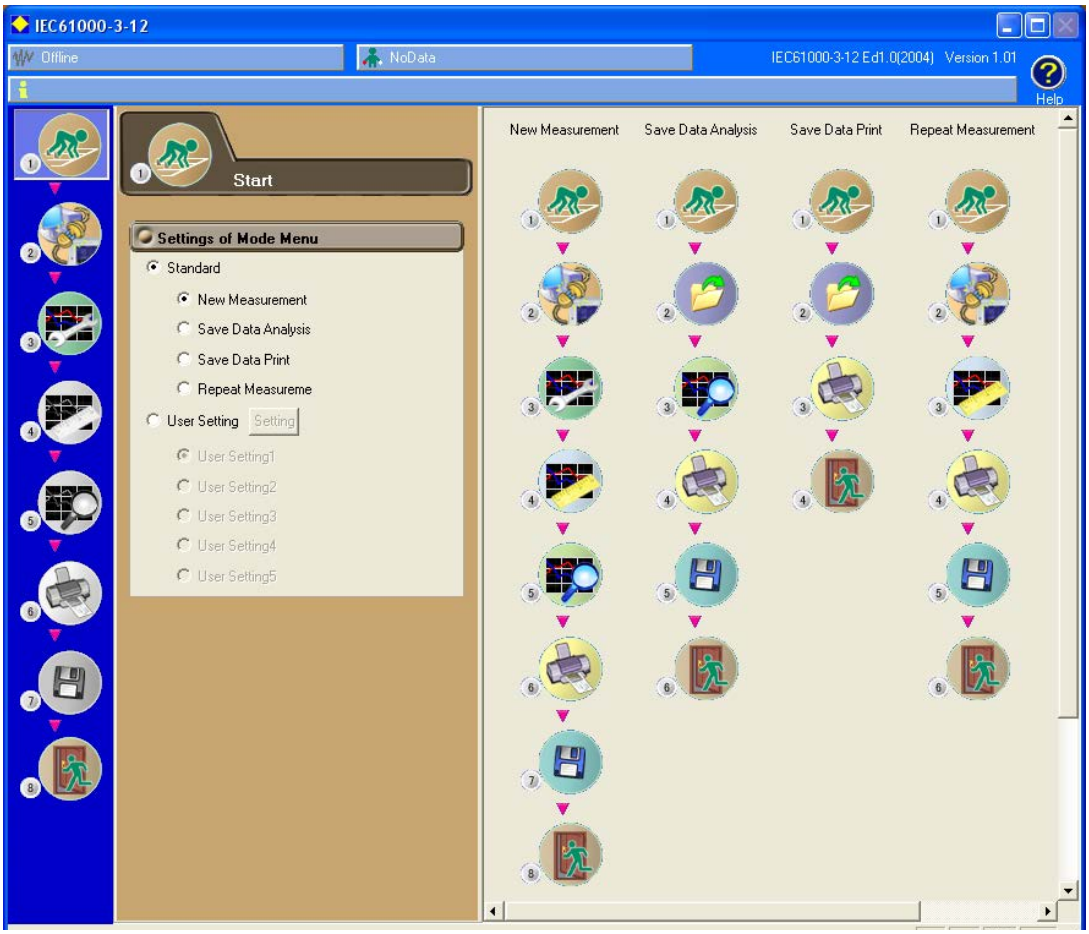
Selecting a Standard

2. Select **IEC61000-3-12** to open the IEC 61000-3-12 Harmonic Measurement Software.



Closes the IEC launcher

Starts the IEC 61000-3-12 Harmonic Measurement Software



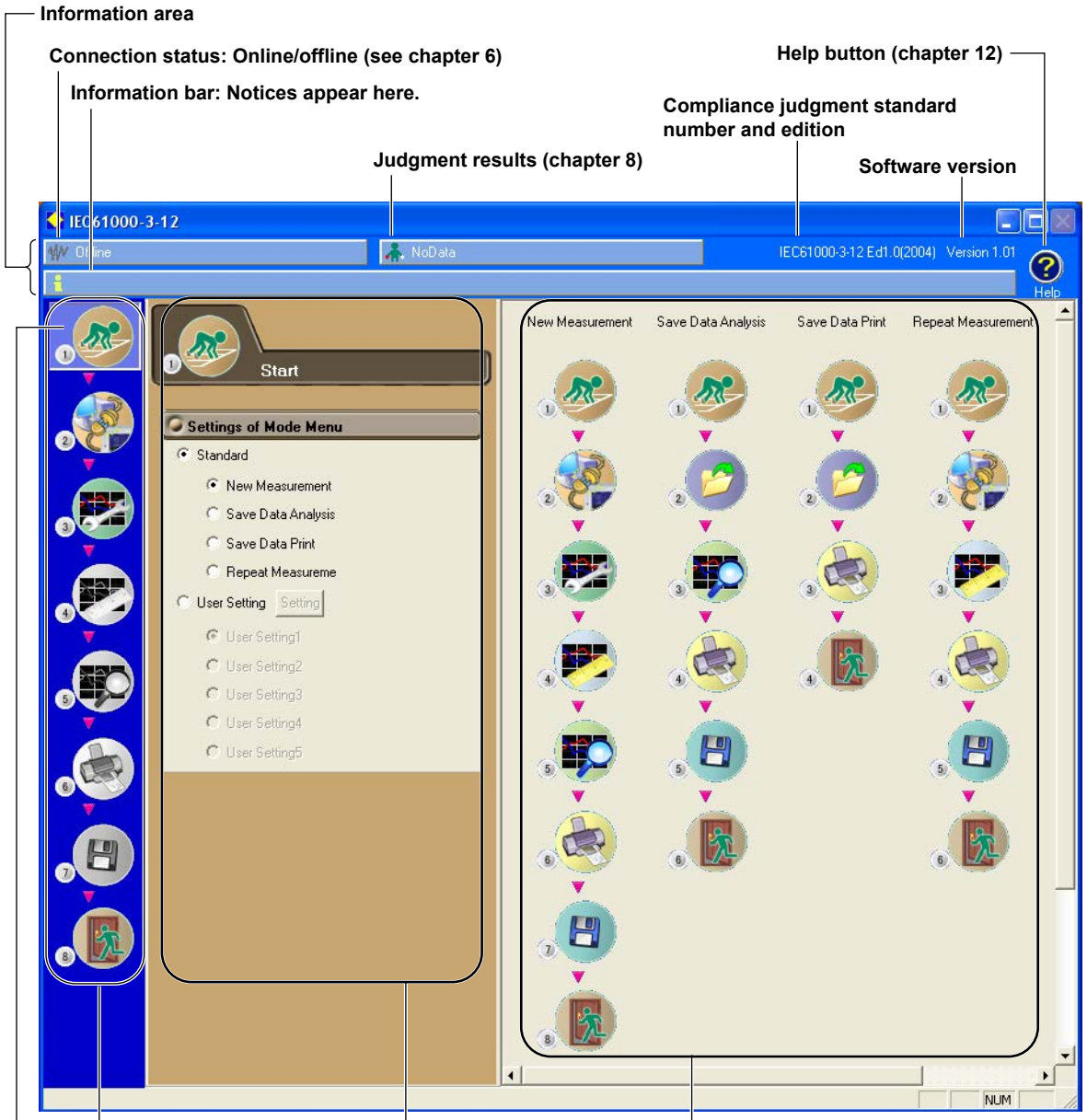
Explanation

You can start this software by accessing its shortcut from the start menu's program folder. This software is installed in the location that you specified in the previous chapter.

Selecting a Standard

To analyze the harmonics of a device with an electric current above 16 A and not greater than 75 A, select IEC 61000-3-12. The Harmonic Measurement Software will start. If you select a different standard, the program that corresponds to that standard will start. For information about the programs that correspond to other standards, see their user's manuals.

3.2 Basic Operations



Menu Area Icons

Start
Use to select and edit test schedule menus. There are four preset standard menus available, in addition to custom menus that you can make yourself (located under the “User Setting” option button).

Open
Use to open the following kinds of files:
• Setting information files that contain information such as measurement conditions and judgment conditions.
• Measured data files that contain measured data acquired by the PC from a WT.

Connection
Use to connect the PC to the WT through a GP-IB or Ethernet interface.

Setting
Use to set measurement and judgment conditions.

Measure
Use to measure harmonics. You can also preview harmonic data and waveforms.

Analysis
Use to display measured results using a variety of lists and graphs.

Print
You can attach comments and titles to a list of measured values and print the list as a report.

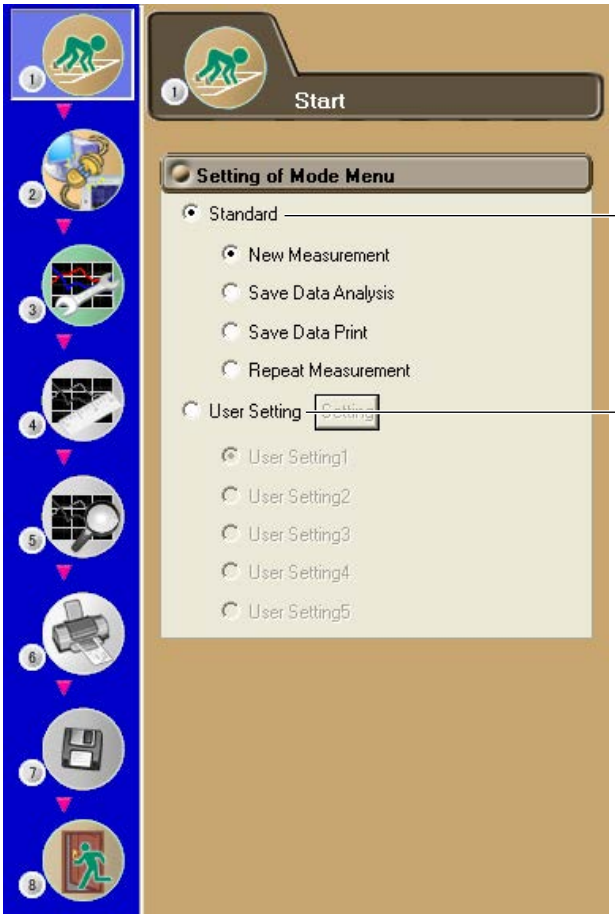
Save
Use to save the following kinds of files.
• Setting information files that contain information such as measurement conditions and judgment conditions.
• Measured data files that contain measured data acquired by the PC from a WT.
• CSV files that contain measured data and waveform data.

Exit
Use to close the software.

4.1 Selecting a Test Schedule Menu

Procedure

1. Select the icon in the menu area. The Start submenu appears.

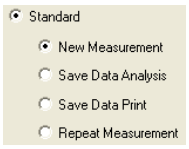


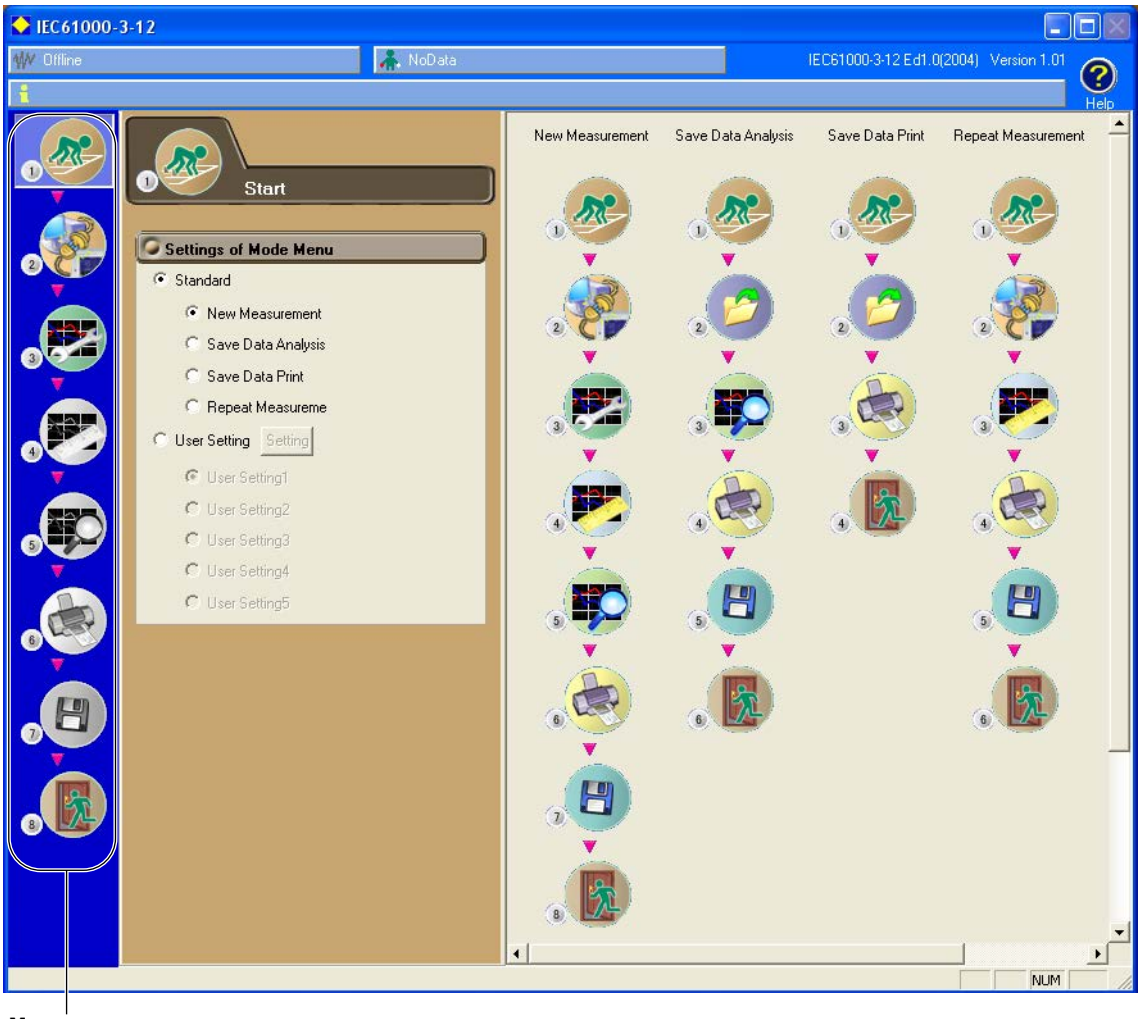
Standard (page 4-2)
There are four standard menus.

User Setting (page 4-3)
You can select and edit specific custom test schedule menus.

Selecting One of the Standard Menus

2. Click **Standard**.
3. Select one of the following test schedule menus. The test schedule menu that you select will appear in the menu area on the left.
   - New Measurement
   - Save Data Analysis
   - Save Data Print
   - Repeat Measurement

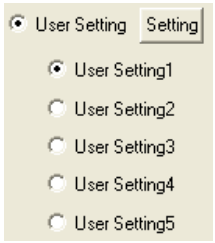


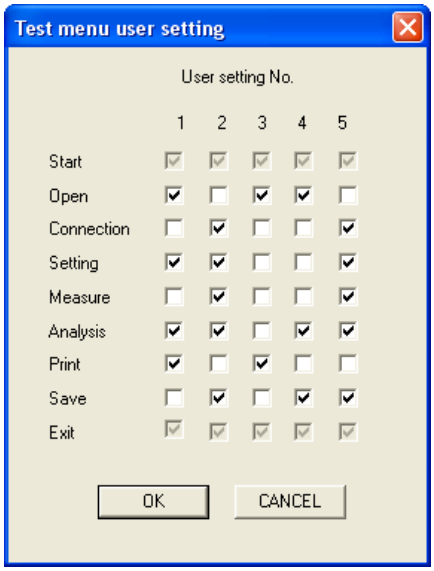


Menu area
The icons of the test schedule menu that you select appear.

Creating Your Own Custom Menu (User Setting)

2. Click **User Setting**.
3. Click **Setting**. The menu customization dialog box appears (the dialog box is labeled “Test menu user setting”).
4. Use the check boxes to select the menu items that you want to include in each of the five custom menus (labeled as “User Setting” 1 to 5 in the start window).
5. Click **OK**.
6. Select the custom menu that you want to use from “User Setting” 1 to 5. The custom menu that you select will appear in the menu area on the left.





Explanation

Selecting a Test Schedule Menu

A test schedule menu lays out the overall test structure. You can choose from test schedule menus that contain different combinations of the following 9 steps. For more information on each step, see sections 1.1 and 2.3.

Start: Select and edit test schedule menus.

Open: Load measured data and WT setting information files.

Connection: Configure the connection between the PC and a WT.

Setting: Set compatibility and measurement conditions.

Measure: Measure voltage fluctuation and flicker.

Analysis: Display measured results as bar and trend graphs.

Print: Print screen images and reports.

Save: Save measured data and setting information files.

Exit: Close the software.

Icon Display

Icon Number
This number indicates an icon's order in a menu.

Standard Menus

The following four standard menus are available.

- New Measurement: Set measurement and judgement conditions, make measurements, and then print and save the data.
- Save Data Analysis: Analyze, print, and save data that was measured and saved in the past.
- Save Data Print: Print data that was measured and saved in the past.
- Repeat Measurement: Make measurements with the same measurement and judgement conditions that you used for the previous measurement, and print and save data without analyzing it.

Setting Up Custom Menus

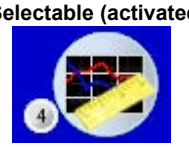
You can create custom test schedule menus by selecting what steps to include in them. You can create up to five different custom test schedule menus.

- Start and Exit steps are always selected. You cannot deselect them.
- The steps are arranged in the order that they appear in in the menu customization dialog box. You cannot change this order.

Icon Activation/Deactivation

Some icons cannot be selected out of order. These icons are grayed out.

Selectable (activated)



Not selectable (deactivated)

For example, the Measure icon cannot be selected when the Connection menu has been set such that the software is in offline mode. Icons such as Open, Connection, and Setting cannot be selected during measurement.

The following is a list of each icon and when it cannot be selected.

Start	During measurement
Open	During measurement
Connection	During measurement
Setting	During measurement
Measurement	When the software is in offline mode
Analysis	During measurement, or when there is no measured data to analyze
Print	During measurement, or when there is no measured data to print
Save	During measurement, or when there is no measured data to save
Exit	During measurement

4.2 Closing the Software

Procedure

1. Select the icon in the menu area. The Exit submenu appears.

Closing the IEC 61000-3-12 Harmonic Measurement Software

2. Click **Exit**. The software closes.

Closing the IEC61000 Launcher

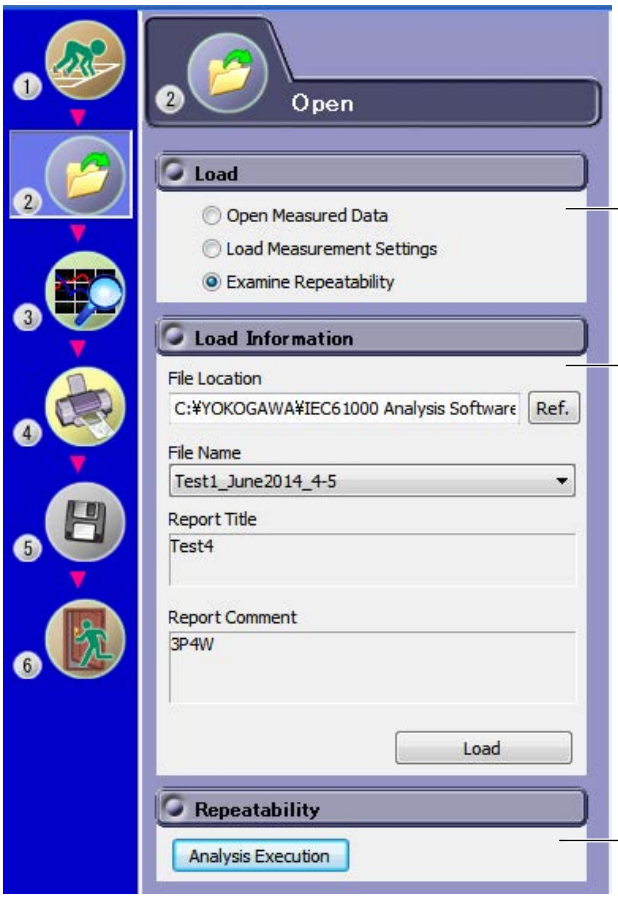
Click the icon below.

Closes the IEC launcher

5.1 Loading Setting Information and Measured Data

Procedure

1. Select the icon in the menu area. The Open submenu appears.



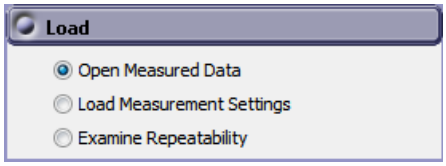
Load (page 5-2)
Select the type of data to load.

Load Information (page 5-2)
Select a file to open. When you select a file, its information appears.

Repeatability (section 5.2)
Analyzes the repeatability of measured data.
(Appears only when Load (see above) is set to Examine Repeatability)

Selecting the Type of Data to Load

2. Select one of the two data types listed under Load.



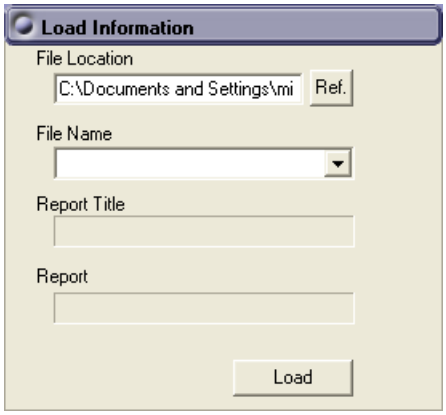
Selecting a File to Open

3. Specify the file location. There are two places where you can specify the file location.
- Under Load Information in the submenu
- At the top of the setting and display area

When you specify the file location, information about the files that can be loaded appears in the setting and display area.

4. Select a file to open. When there is more than one available file, you can select which file to open using one of the following two methods.
- Click ▼ next to the File Name box under Load Information. A list of available files appears. Select a file from the list.
- Select a file to open from one of the files listed in the setting and display area.

5. Click **Load**, or double-click the file you want to open. The software will open the measured data or setting information file.

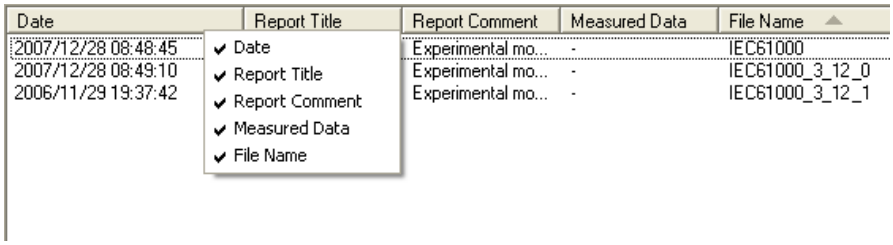


Note

- When the software is in online mode, it will switch to offline mode if you load setting information or measured data.
- If an error occurs while loading the setting information, the settings are reset to their default values.
- If an error occurs while loading measured data or setting information, the data may not be loaded properly. Confirm the filename and extension and then reopen the file.
- You cannot load setting information, measured data, or waveform data while making measurements.

Configuring File Information Display Settings

1. Right-click the file information heading area at the top of the setting and display area. A list of the different types of information that can be displayed appears.
2. Select the type of information that you want to be displayed.



Explanation

Loading Setting Information

You can load the setting information that has been saved using the procedure described in section 11.1.

- A dash appears in the General Data and Manual Data columns for setting information files.
- Setting information file names have the following extension.
  Extension: .ini
- Setting information files contain the following:
  - Measurement and judgment conditions (see chapter 7)
    Data that has been acquired from the WT or loaded from a file can be judged using loaded judgment conditions.
  - Display settings (see chapters 8 and 9).
  - Report titles and comments (see section 10.1)
    You can put comments and titles on reports of data acquired from the WT or loaded from files, and then print and save the reports. For more information about printing and saving, see chapters 10 and 11.

Loading Measured Data, Waveform Data, and Setting Information

- You can load the measured data, waveform data, and setting information that has been saved using the procedure described in section 11.1.
- You cannot load measured data, waveform data, or setting information while running the harmonic or waveform preview on the Measure page.
- An asterisk appears in the Measured data column for files that contain measured data.
- Files that contain measured data are composed of two types of files with the following extensions.
  Extension: .fdt Measured data
  .ini Setting information

Note

This software cannot load CSV files.

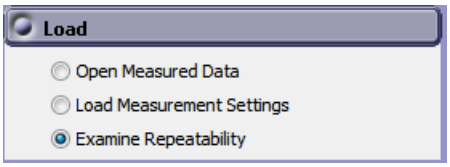
Kinds of File Information

- Date: When the file was saved. Displayed in this format: year/month/day hour:minute: second
- Report Title (See section 10.1)
- Report Comment (See section 10.1)
- Measured Data: When measured data is included in a file, an asterisk appears.
- Click ▼ or ▲ to switch between sorting in ascending and descending order.

5.2 Checking the Repeatability of the Measured Data

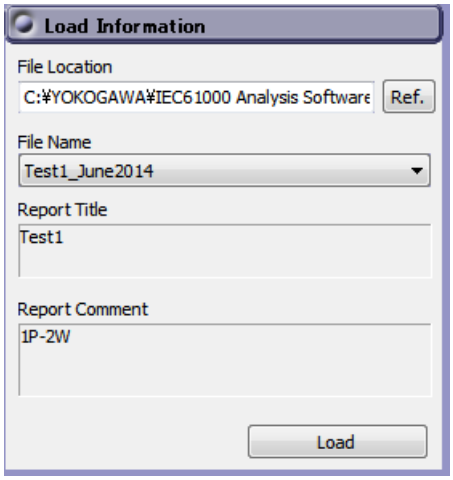
Procedure

1. Select the icon in the menu area. The Open submenu appears. For general information about the Open submenu, see section 5.1.
2. Select **Examine Repeatability** listed under Load.

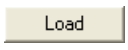


Selecting a File to Open

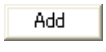
3. Specify the file location. There are two places where you can specify the file location.
   - Under Load Information in the submenu



   - At the top of the setting and display area
     When you specify the file location, information about the files that can be loaded appears in the setting and display area.
4. Select a file to open. You can select which file to open using one of the following two methods. Information about the selected file is displayed at the bottom of the setting and display area in the file analysis list.
   - Click ▼ next to the File Name box under Load Information. A list of available files appears. Select a file from the list and Click **Load**.



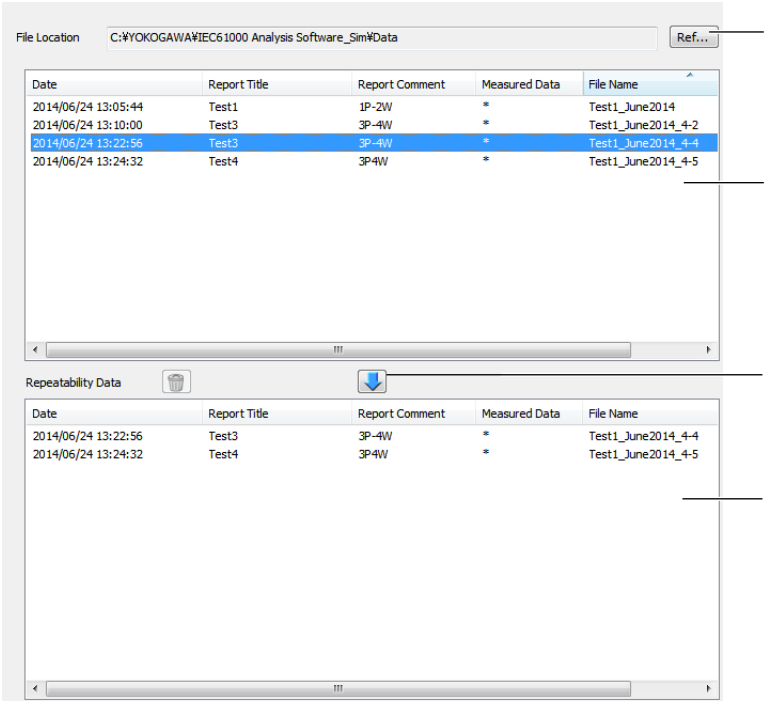
   - Double-click a file in the measured data file list.
   - Drag a file from the measured data file list to the file analysis list.
   - Click while a file is selected in the measured data file list.
   - Right-click a file in the measured data file list, and then click **Add**.



Note

This software can load data saved in files with .fdt and .ini extensions. This software cannot load CSV files (files with .csv extensions).

5. Repeat step 4 to select all of the files that you want to compare.



Specify the measured data file location.

Measured data file list

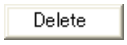
Click to add the file currently selected in the upper measured data file list to the lower file analysis list.

File analysis list
A list of the files selected for repeatability analysis.

Unselecting a File Selected for Analysis

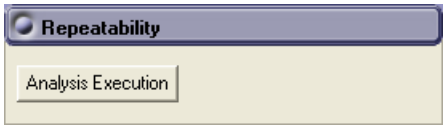
6. To unselect a file selected for analysis:

- Click while a file is selected in the file analysis list.
- Drag a file in the file analysis list to .
- Press DELETE while a file is selected in the file analysis list.
- Right-click a file in the file analysis list, and then click **Delete**.



Starting Analysis

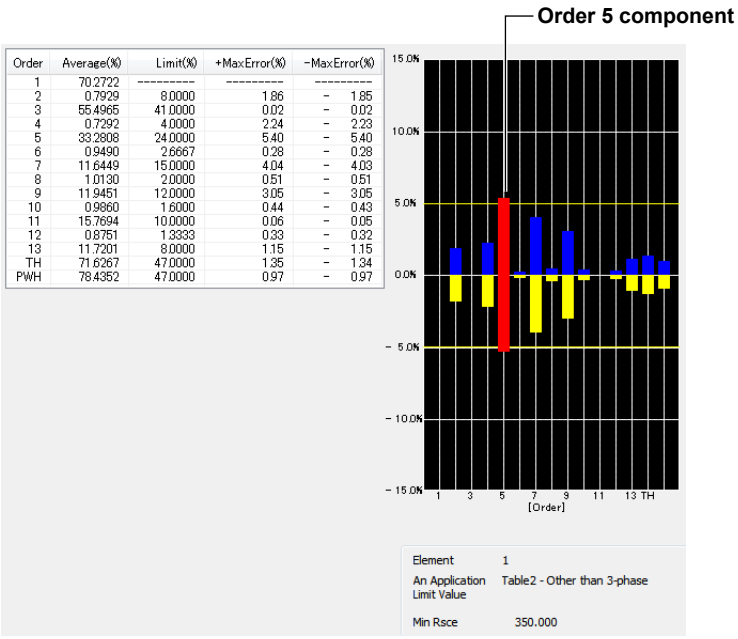
7. Click **Analysis Execution**. The analysis menu appears, and the results of the analysis of the measured data's repeatability appear.



Note

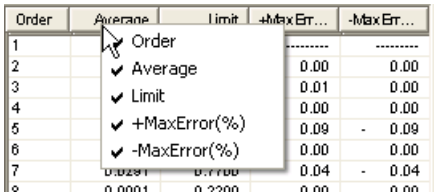
- If only one file has been selected for analysis, the Analysis Execution button will be unavailable.
- If the software is in online mode, it will switch to offline mode when analysis starts.
- In the analysis menu, items other than repeatability will be dimmed and unavailable.
- When you start analysis, the Measure and Save menus will be dimmed and unavailable.

Example of Comparison: The difference at order 5 exceeds 5%.



Configuring File Information Display Settings

1. Right-click the file information heading area at the top of the setting and display area. A list of the different types of information that can be displayed appears.
2. Select the type of information that you want to be displayed.



Note

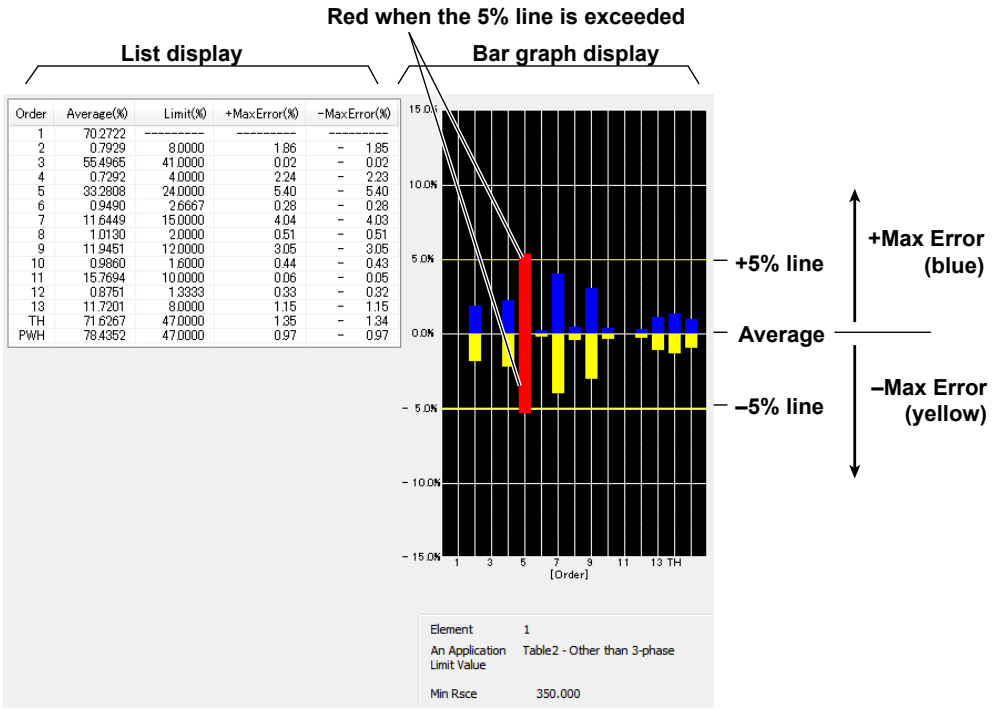
The order is always displayed. You cannot hide it.

Explanation

The mean value in the harmonics measurement data saved to files can be compared, and the difference in the measured data can be displayed on a bar graph and list for each order. This function can be used to evaluate whether the difference between data measured under the same measurement conditions when harmonics are measured using the same product or same product model is within 5% of the limits (confirmation of repeatability).

Repeatability of Measurement Data Window

The following figure shows an example of comparison.



Maximum (Mnmax)

Maximum value among the average values of harmonic currents of each order

Minimum (Mnmin)

Minimum value among the average values of harmonic currents of each order

Average (Mnmean)

Average of the average values of each order of harmonic currents of the selected file

+Max Error

Ratio (%) of the difference between Mnmax and Mnmean of each order

$$\frac{\text{Mnmax} - \text{Mnmean}}{\text{Limit}} \times 100$$

–Max Error

Ratio (%) of the difference between Mnmin and Mnmean of each order

$$\frac{\text{Mnmin} - \text{Mnmean}}{\text{Limit}} \times 100$$

Color

- **Bar Graph**

  The bar graph that is displayed for each order is displayed using a length converted from the +Max Error or –Max Error. The meaning of the colors is indicated in the following table.

Blue	Difference (error) less than the +5% line for +Max Error.
Yellow	Difference (error) less than the –5% line for –Max Error.
Red	Difference (error) greater than or equal to the +5% line for +Max Error. Difference (error) greater than or equal to the –5% line for –Max Error.

* The names of the sample colors of Microsoft Word or Excel are used for the names of the colors.

- **List**

  The average, limit, +maximum error, and –maximum error for each order are displayed using values in black.

Number of Files That Can Be Compared

To evaluate the repeatability of the measured data, multiple files must be selected.
Number of files that can be compared: 2 to 10

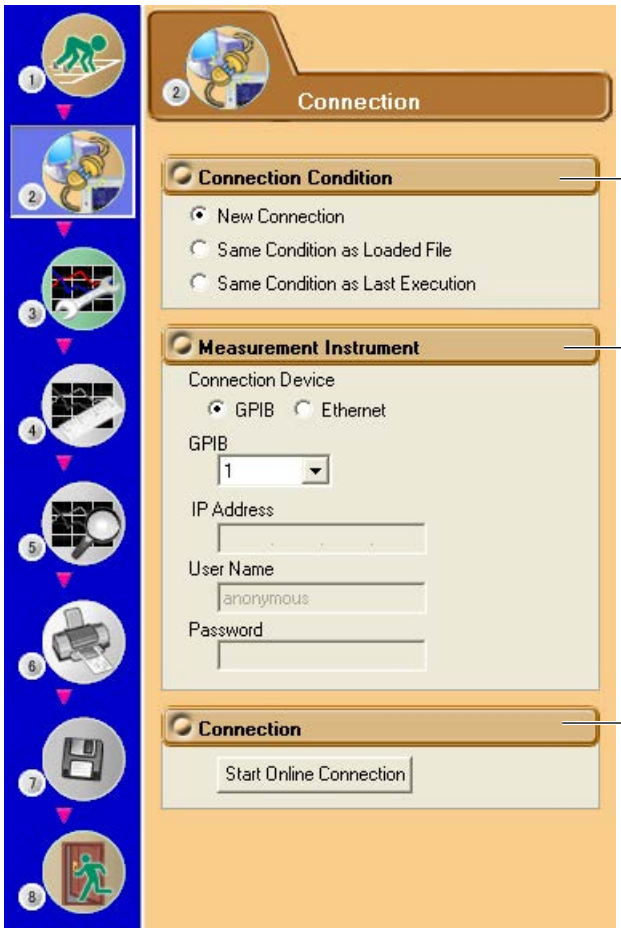
Note

- Even if only one file is selected, the Repeatability of Measurement Data window will open. In this case, no comparison is made.
- To evaluate the repeatability, check that the measured data saved to the file to be compared was measured under the following conditions.
  - Same DUT (not the same model, but the same equipment).
  - Same test conditions.
  - Same test equipment.
  - Same atmospheric conditions (when the DUT is affected by them).

6.1 Establishing a New Connection Between the PC and a WT

Procedure

1. Select the icon in the menu area. The Connection submenu appears.



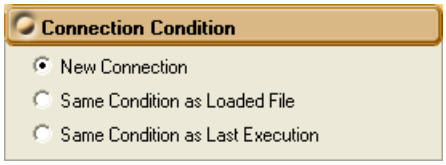
Connection Condition (page 6-2)
Select the connection condition (the connection settings).

Connection Device (page 6-2)
Select the communication interface and configure the connection settings.

Connection (page 6-3)
Switch between online and offline mode.

Connection Condition

2. Select **New Connection**.



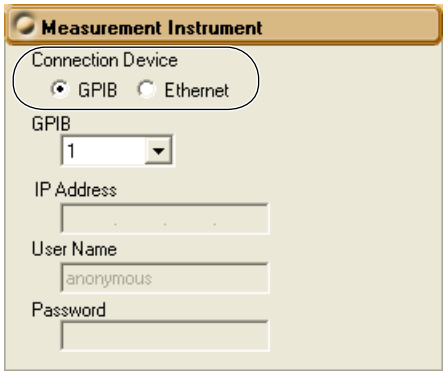
Note

- You can only select Same Condition as Loaded File if you load setting information or measured data using the procedure described in section 5.1.
- You cannot select Same Condition as Last Execution when you first start up the software.

Connection Device

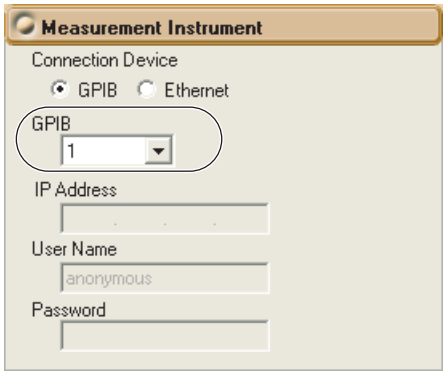
3. Select **GPIB** or **Ethernet**.

- If you select GP-IB, proceed to step 4.
- If you select Ethernet, proceed to step 5.



Selecting a Communication Address (GP-IB)

4. Select the GP-IB address of the WT that you intend to connect to.



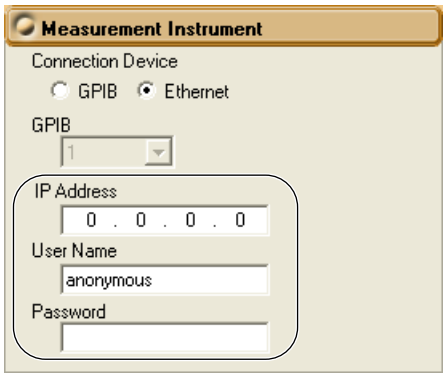
Proceed to step 6.

Note

GP-IB address number 0 is reserved for the PC and cannot be selected.

Setting the IP Address, User Name, and Password (Ethernet)

5. Set the IP address, user name, and password of the WT that you intend to connect to.



Making the Connection

6. Click **Start Online Connection**. The software will establish a connection between the PC and the WT. The configuration and measurement operations listed onwards can be performed once the software has automatically determined that communication is possible.

Note

- You cannot proceed to measurement, analysis, printing, or saving until an online connection has been established.
- If you click Start Online Connection and establish a connection, but the connected WT is not in a measurement-ready state, a communication error will occur. If the GP-IB address, IP address, user name, or password is wrong, or if the PC is simply unable to connect to the WT, a communication error will occur.

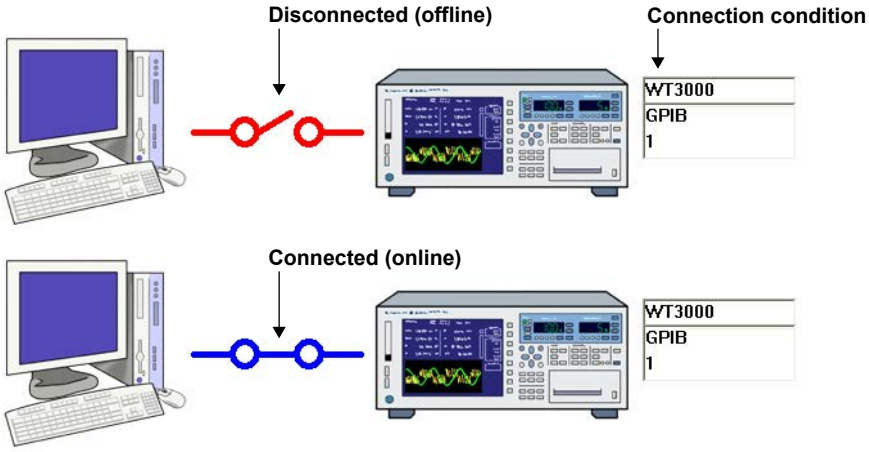
Explanation

Selecting a Communication Address

- **GP-IB**
  - Select the GP-IB address of the WT that you intend to connect to.
    Selectable range: 1 to 30
- **Ethernet**
  - Set the IP address of the WT that you intend to connect to.
    Selectable range: 0.0.0.0 to 255.255.255.255
  - You can set the user name and password of the WT that you intend to connect to.
    Usable characters: Those characters that the WT supports.

Displaying Connection Conditions and Status

The connection conditions that you set in the Connection submenu appear in the setting and display area along with the current connection status.



The connection status also appears in the information area.

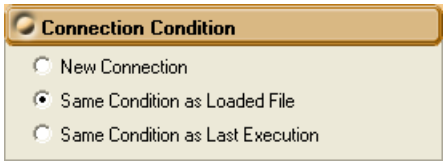
Note

- It can take more than 10 seconds to switch from offline to online mode.
- We recommend that you use a National Instruments GP-IB card. GP-IB cards made by other companies may not function properly.

6.2 Using the Connection Settings from a Loaded File

Procedure

1. Select the icon in the menu area. The Connection submenu appears. For general information about the Connection submenu, see section 6.1.
2. Select **Same Condition as Loaded File** under Connection Condition.



Note

You can only select Same Condition as Loaded File if you load setting information using the process described in section 5.1.

Making the Connection

3. Click **Start Online Connection**. The software will establish a connection between the PC and the WT. The configuration and measurement operations listed onwards can be performed once the software has automatically determined that communication is possible.

Note

- You cannot proceed to measurement, analysis, printing, or saving until an online connection has been established.
- If you click Start Online Connection and establish a connection, but the connected WT is not in a measurement-ready state, a communication error will occur. If the GP-IB address, IP address, user name, or password is wrong, or if the PC is simply unable to connect to the WT, a communication error will occur.

Explanation

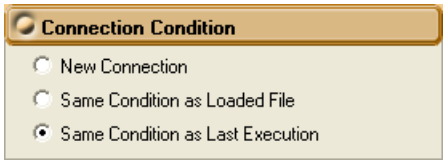
Follow this procedure to use the settings from a file that has been loaded according to the procedure described in “Loading Setting Information” in section 5.1.

6.3 Using the Same Connection Settings as Before

Procedure

1. Select the icon in the menu area. The Connection submenu appears. For general information about the Connection submenu, see section 6.1.

2. Select **Same Condition as Last Execution** under Connection Condition.



Note

You cannot select Same Condition as Last Execution when you first start up the software.

Making the Connection

3. Click **Start Online Connection**. The software will establish a connection between the PC and the WT. The configuration and measurement operations listed onwards can be performed once the software has automatically determined that communication is possible.

Note

- You cannot proceed to measurement, analysis, printing, or saving until an online connection has been established.
- If you click Start Online Connection and establish a connection, but the connected WT is not in a measurement-ready state, a communication error will occur. If the GP-IB address, IP address, user name, or password is wrong, or if the PC is simply unable to connect to the WT, a communication error will occur.

Explanation

Follow this procedure to set the connection settings to the same as when you last closed this software.

6.4 Ending a Connection by Switching to Offline Mode

Procedure

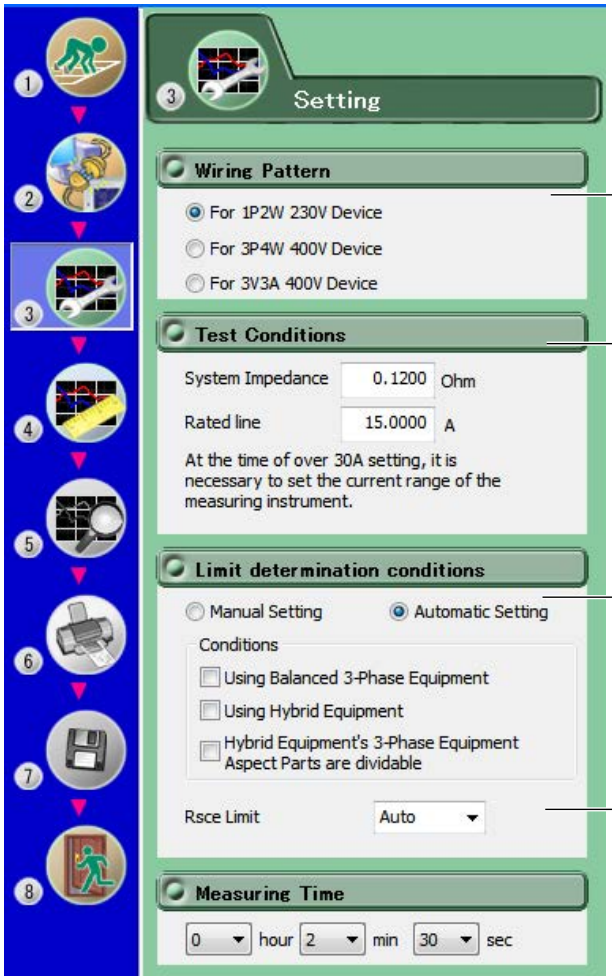
1. Select the icon in the menu area. The Connection submenu appears. For general information about the Connection submenu, see section 6.1.

2. When you are in online mode, click **Exit online connection**. The software will disconnect from the WT.

7.1 Setting General Test Conditions

Procedure

1. Select the icon in the menu area. The Setting submenu appears.

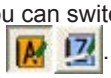


Input Current (page 7-2).
Select the current range to measure.

Wiring pattern (page 7-2)
Select the wiring pattern of the circuit whose current you will measure.

Test conditions (page 7-2)
Set the test conditions.

Measurement time (page 7-3)
Set the measurement time based on the conditions of the EUT.

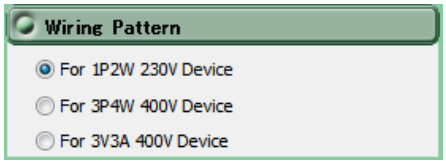
In the setting and display area, you can switch between basic settings and advanced settings by clicking these buttons:  . For details, see sections 7.2 and 7.3.

Basic settings

Advanced settings

Wiring Pattern

2. Select the wiring pattern of the circuit you will measure.



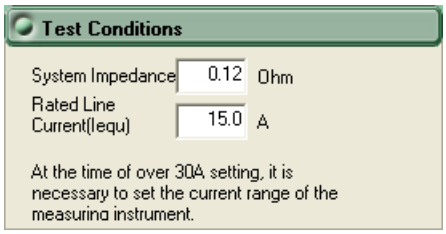
Note

When you switch wiring patterns, the following settings, which are displayed in the setting and display area, will change to default values that are appropriate to the wiring pattern that you select. For details, see sections 7.2 and 7.3.

- The WT3000 settings (the settings on the WT Measurement Instrument tab)
- The testing judgment conditions (the settings under the Standard tab).

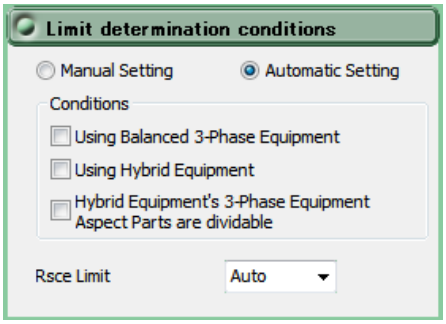
Test Conditions

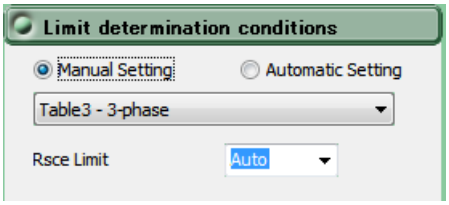
3. Set the System Impedance (Z) and the Rated Line Current (I_{equ}).



Limit Determination Conditions

4. Set the conditions that determine the limits.





Measurement Time

5. Set the measurement time.

Note

When you change test conditions, limit determination conditions, or the measurement time, the judgment conditions on the standard tab that are displayed in the setting and display area will change accordingly. For details, see section 7.3.

Explanation

Test Conditions

You can set the system impedance (Z) and the rated line current (I_{equ}) within these ranges:
System impedance (Z): 0.01 to 1000 Ω
Rated line current (I_{equ}): 0 to 1000 A

If you set the rated line current (I_{equ}) to a value greater than 20 A, in order to keep the voltage drop caused by the input impedance of the current input circuit to 0.15 Vrms or less, use a current sensor to measure the current rather than directly connecting the current to the WT. Set the WT current range and sensor ratios according to the procedure in section 7.2.

Limit Determination Conditions

Set the conditions that determine the limits. This setting determines what limits will be applied when testing. For details about the values of the limits, see section 1.3.

Measurement Time

The measurement time is the time between the start of the measurement to the end of the measurement. The time for measuring harmonics can be set in advance. The harmonics can be measured continuously for the specified time. The measurement time can be changed when equipment that emits harmonics that fluctuate over time is measured or when confirming that the emitted harmonics do not change even when the equipment is operated over extended time.

Selectable range: 0 H 0 M 1 S to 24 H 0 M 0 S in units of 1 s.

- An error occurs if a time exceeding 24 hours is specified.
- If the measurement time is set to 0 H 0 M 0 S and the measurement is started, measurement continues until you choose Stop Test from the Measure menu or click the stop test icon on the toolbar.

Note

Depending on the environment of the PC onto which this software was installed, an error occurs if you specify a time longer than the memory area that can be reserved. In this case, you may be able to increase the available time by exiting other applications or by increasing the amount of memory available to the PC.

7.2 Setting the WT3000 Measurement Conditions

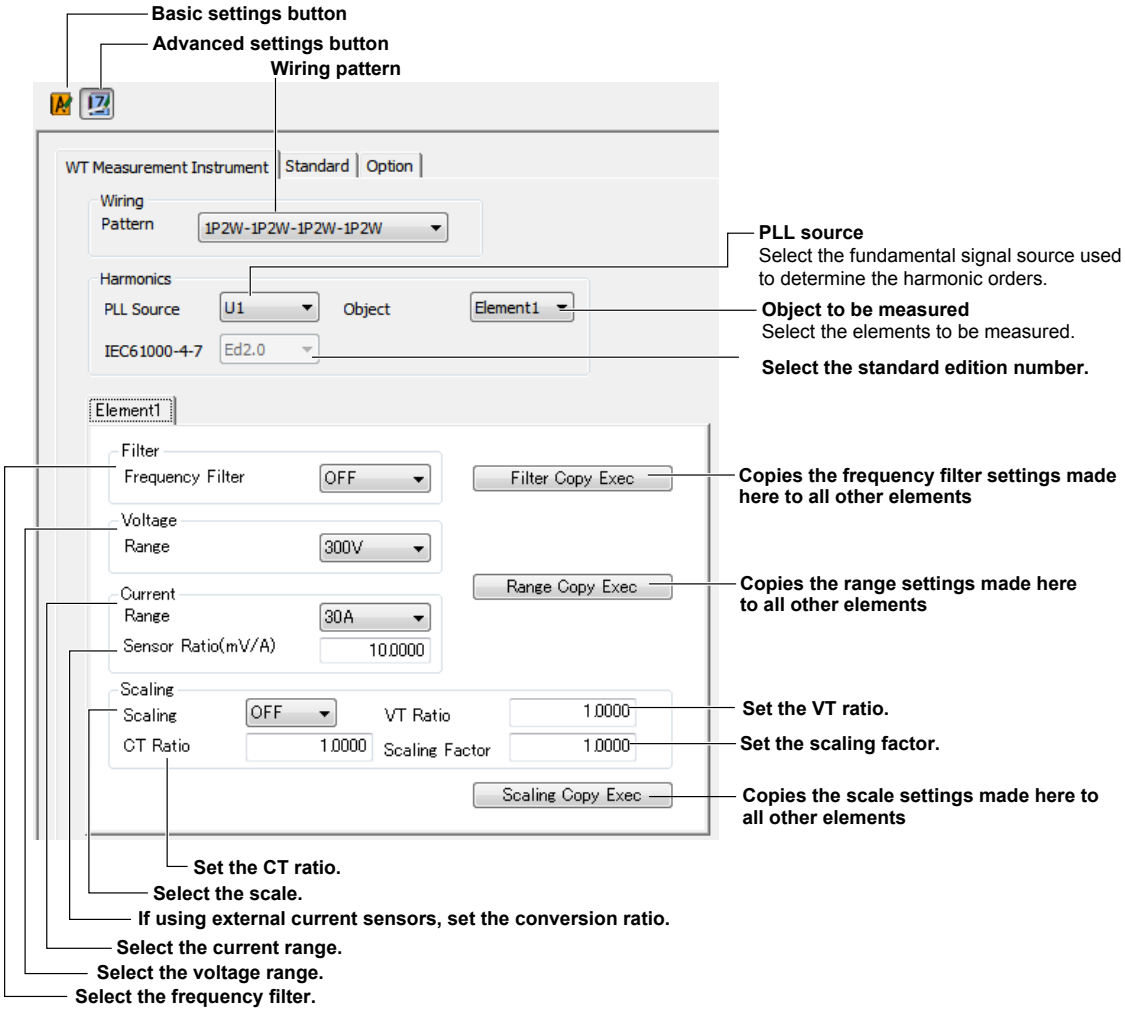
Procedure

1. Select the **WT Measurement Instrument** tab in the setting and display area. The WT3000 measurement condition configuration dialog box appears.
2. Click the basic settings button or the advanced settings button .
3. Configure the various settings.

Note

When you select the basic settings button, the following settings are unavailable. To adjust these settings, click the advanced settings button.

- Frequency Filter and Filter Copy Exec
- Scaling Copy Exec
- All of the settings under Scaling



Explanation

Standard Edition Number

If the WT firmware version is 4.11 or later, you can select the IEC61000-4-7 edition number.

IEC61000-4-7 edition numbers

- Edition 1.0
- Edition 2.0
- Edition 2.0 A1

IEC61000-4-7 define requirements for measurement instruments. For details, see chapter 14. If the WT3000 firmware version is between 4.01 and 4.10, the edition number is fixed to IEC61000-4-7 Edition 2.0.

Copying the Frequency Filter

You can copy the frequency filter settings configured for one element to all other elements with the same wiring.

Copying the Range

You can copy the range settings configured for one element to all other elements with the same wiring. The voltage range and the current range are copied.

Copying the Scaling Settings

You can copy the scaling settings configured for one element to all other elements with the same wiring. The settings that are copied are:

- External current sensor conversion ratio
- VT ratio
- CT ratio
- Scaling factor

For information about the following settings and how to make settings from the WT, see the WT3000 User's Manual (IM760301-01E).

Setting	Corresponding user's manual and section	
Wiring Pattern	IM760301-01E	Section 4.1
PLL source	IM760301-51E	Section 7.5
Frequency filter	IM760301-01E	Section 4.8
Voltage/current range	IM760301-01E	Sections 4.3 and 4.4
Scaling	IM760301-01E	Section 4.5

Note

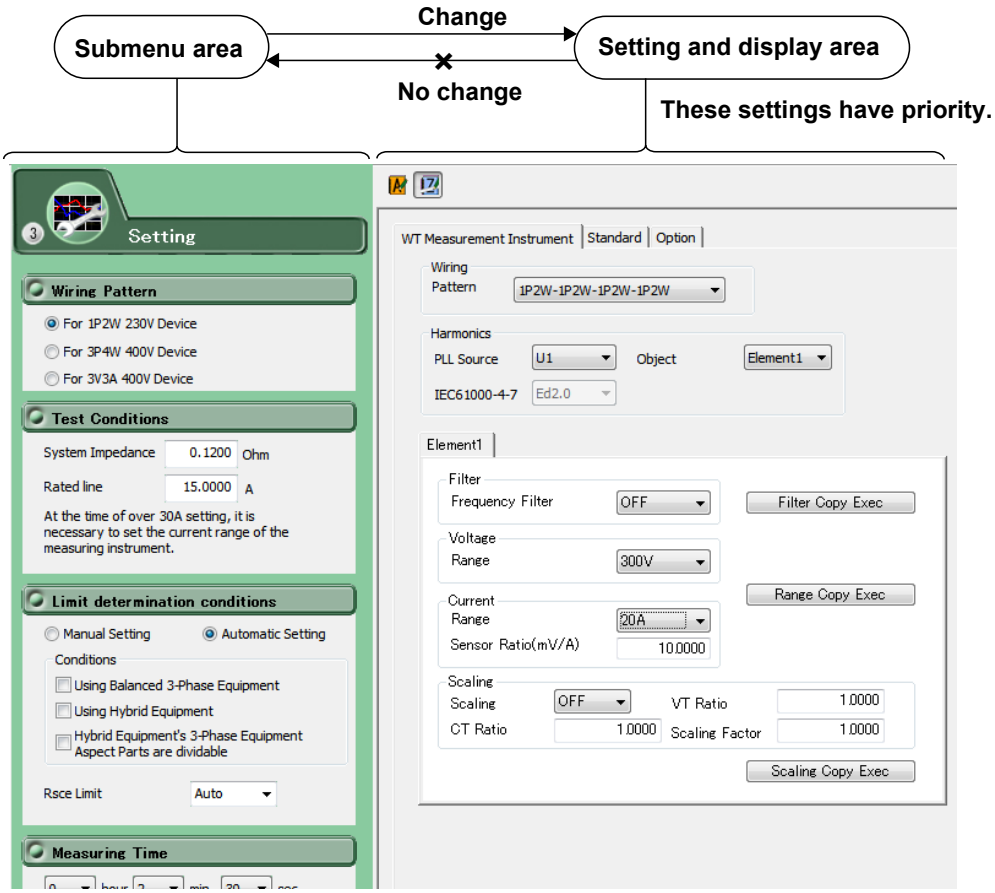
- When the wiring system is pattern 1 (when all are 1P2W), filter, range, and scaling are copied to all other elements.
- When taking measurements with this software, the antialiasing filter cutoff frequency is fixed at 5.5 kHz.
- To make accurate measurements, turn ON the frequency filter of the input element set to PLL source.
- The exponential average function of the WT3000 is ON.

Shared Settings between the Submenu and the Setting and Display Area

When you change the following settings in the submenu, the settings in the setting and display area will also change.

- Wiring Pattern (see page 7-7)
- Test Conditions (see section 7.3)
- Conditions for applying limits (see section 7.3)
- Measurement time (see section 7.3)

The settings in the submenu will not change when you change the settings in the setting and display area.
When the settings in the submenu and the setting and display area are different, the settings in the setting and display area take precedence.

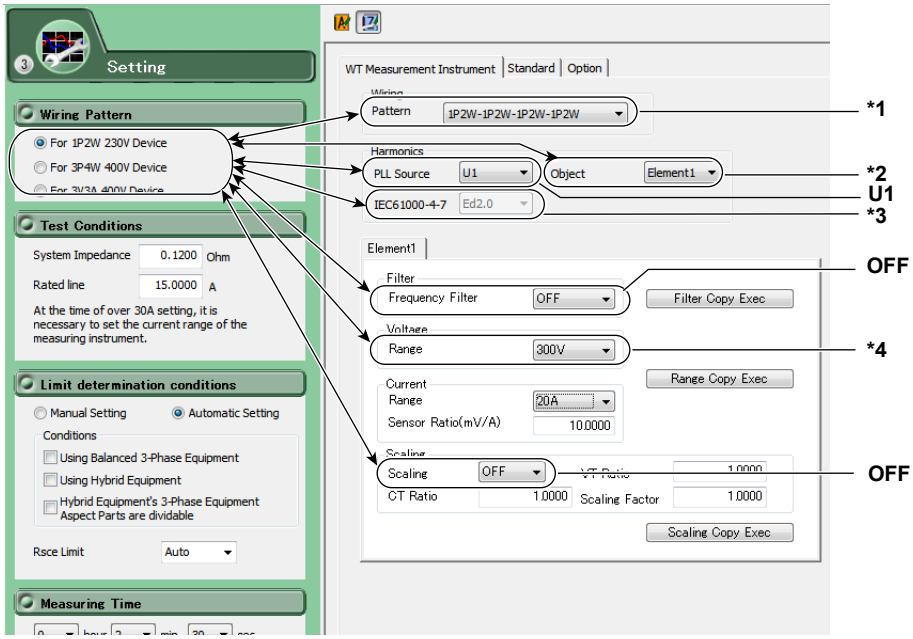


* The default Wiring value varies depending on the number of WT elements.

Number of WT Elements	Default Setting
1	1P2W
2	1P2W-1P2W
3	1P2W-1P2W-1P2W
4	1P2W-1P2W-1P2W-1P2W

Setting Changes Based on Wiring Pattern Selection

When you select a wiring pattern in the Setting submenu, the settings marked off in the following figures change to their default values. The values in the figures are the default values.



* The default Wiring value varies depending on the number of WT elements.

Wiring Pattern	1Element	2Element	3Element	4Element
For 1P2W 230V Devices	1P2W	1P2W-1P2W	1P2W-1P2W-1P2W	1P2W-1P2W-1P2W-1P2W
For 3P4W 400V Devices	1P2W*5	1P2W-1P2W*5	3P4W	3P4W-1P2W
For 3P3W 400V Devices	1P2W*5	1P2W-1P2W*5	3V3A	3V3A-1P2W

*5 An error message appears, because there are not enough elements.

*2, *4 The default setting for Object and Voltage Range varies depending on the wiring pattern.

Wiring Pattern	Object	Voltage Range
For 1P2W 230V Devices	Element 1	300V
For 3P4W 400V Devices	SigmaA *6	300V
For 3P3W 400V Devices	SigmaA *6	600V

*6 If the error described above in *5 occurs because of the selected wiring pattern, Object is automatically set to Element 1.

*3 The default setting depends on the wiring pattern as shown below.

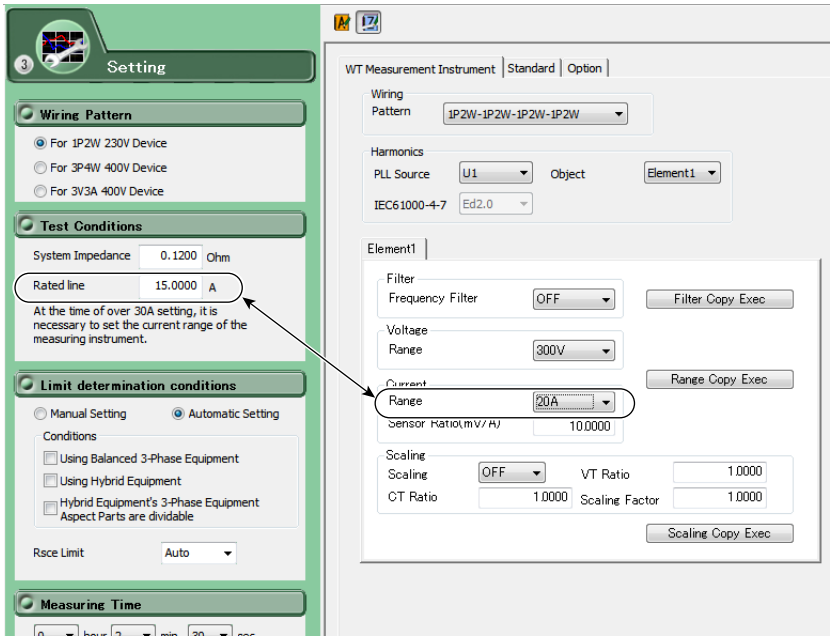
Wiring Pattern	Label	Setting
For 1P2W 230V Devices	IEC 61000-4-7	Ed2.0A1*7
For 3P4W 400V Devices	IEC 61000-4-7	Ed2.0A1*7
For 3P3W 400V Devices	IEC 61000-4-7	Ed2.0A1*7

*7 The default setting depends on the WT firmware version as shown below.

- For versions 4.11 and later, the setting is Ed2.0A1.
- For versions before 4.11, the setting is Ed2.0.

Setting Changes Based on Current Range Selection

When you select a current range in the Setting submenu, the settings marked off in the following figures will also change.



7.3 Setting the WT3000 Judgment Conditions

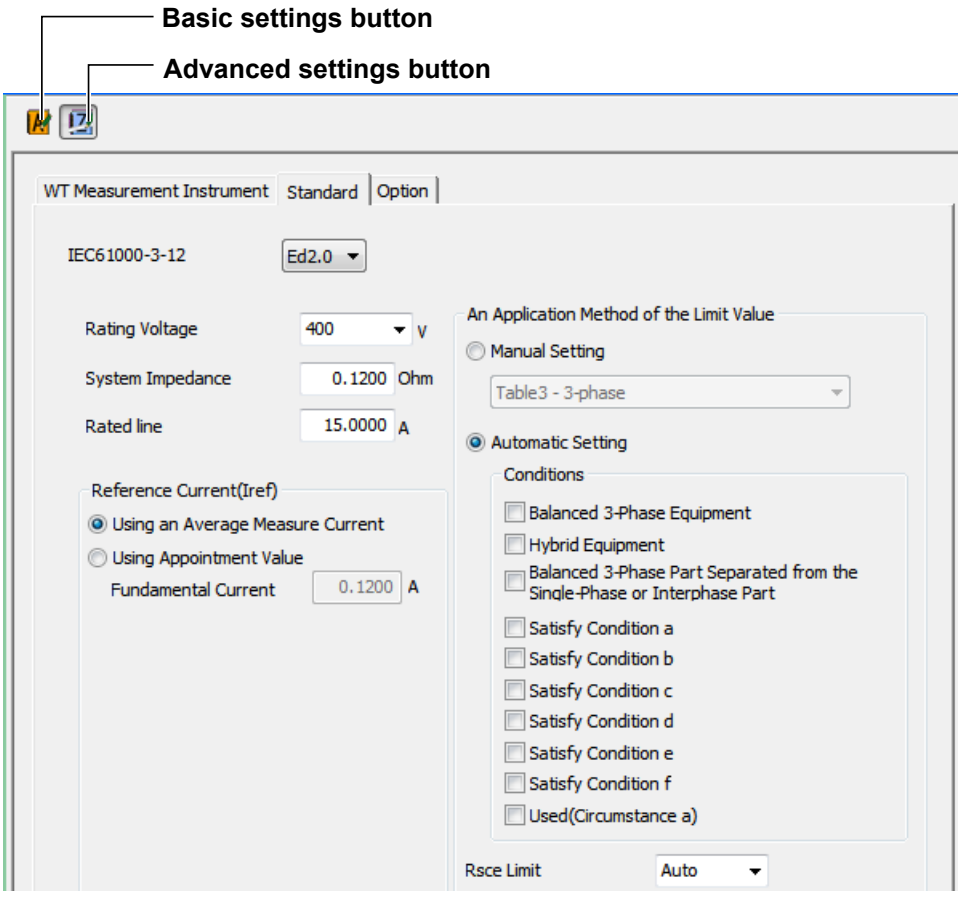
Procedure

1. Select the **Standard** tab in the setting and display area. The judgment condition configuration dialog box appears.
2. Click the basic settings button or the advanced settings button .
3. Configure the various settings.

Note

When you select the basic settings button, the following settings are unavailable.
To adjust these settings, click the advanced settings button.

- Fundamental Current box
- Manual Setting under An Application Method of the Limit Value
- The following items under Conditions
  - Satisfy Condition a
  - Satisfy Condition b
  - Satisfy Condition c
  - Satisfy Condition d
  - Satisfy Condition e
  - Satisfy Condition f



Explanation

For explanations of these terms, see section 1.5.

Rated Voltage

For the rated voltage, you can choose one of the voltages listed below or specify a different voltage.

- When the selected wiring pattern is 1P2W 230V: 100, 200, or 230
- When the selected wiring pattern is 3P4W 400V: 115, 230, or 400
- When the selected wiring pattern is 3V3A 400V: 200 or 400

System impedance (Z), and rated line current (Iequ)

You can set the system impedance (Z) and the rated line current (I_{equ}) within these ranges:

- System impedance (Z): 0.01 to 1000 Ω
- Rated line current (I_{equ}): 0 to 1000 A

If you set the rated line current (I_{equ}) to a value greater than 20 A, in order to keep the voltage drop caused by the input impedance of the current input circuit to 0.15 Vrms or less, use a current sensor to measure the current rather than directly connecting the current to the WT. Set the WT current range and sensor ratios according to the procedure in section 7.2.

Reference Current (Iref)

You can select the reference current from the following options.

- Using an Average Measure Current
- Using Appointment Value

Rsce Limit

For the limit value, you can select how to apply the Rsce limit.

- Auto
- Fixed (select from the drop-down menu)
- Fixed (a specific value): 1 to 999

If you set the Rsce limit using a method other than Auto and a value exceeding the range of limit to be applied is specified, compliance is determined using the maximum or minimum value within the range.

Measurement Time

The measurement time is the time between the start of the measurement to the end of the measurement. The time for measuring harmonics can be set in advance. The harmonics can be measured continuously for the specified time. The measurement time can be changed when equipment that emits harmonics that fluctuate over time is measured or when confirming that the emitted harmonics do not change even when the equipment is operated over extended time.

Selectable range: 0 H 0 M 1 S to 24 H 0 M 0 S in units of 1 s.

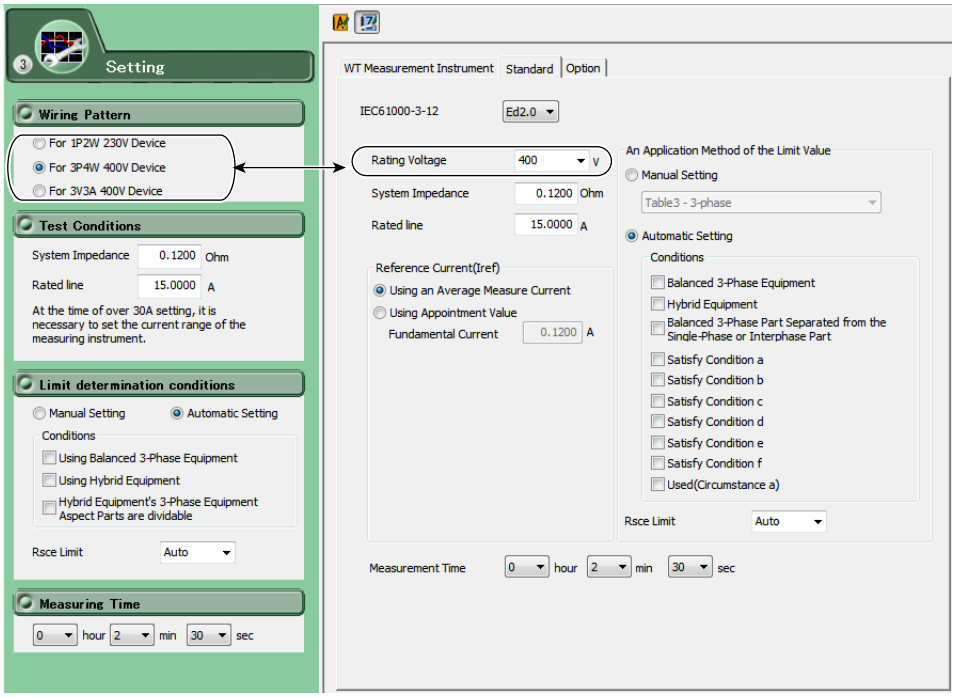
- An error occurs if a time exceeding 24 hours is specified.
- If the measurement time is set to 0 H 0 M 0 S and measurement is started, measurement continues until you choose Stop Test from the Measure menu or click the stop test icon on the toolbar..

Note

Depending on the environment of the PC onto which this software was installed, an error occurs if you specify a time longer than the memory area that can be reserved. In this case, you may be able to increase the available time by exiting other applications or by increasing the amount of memory available to the PC.

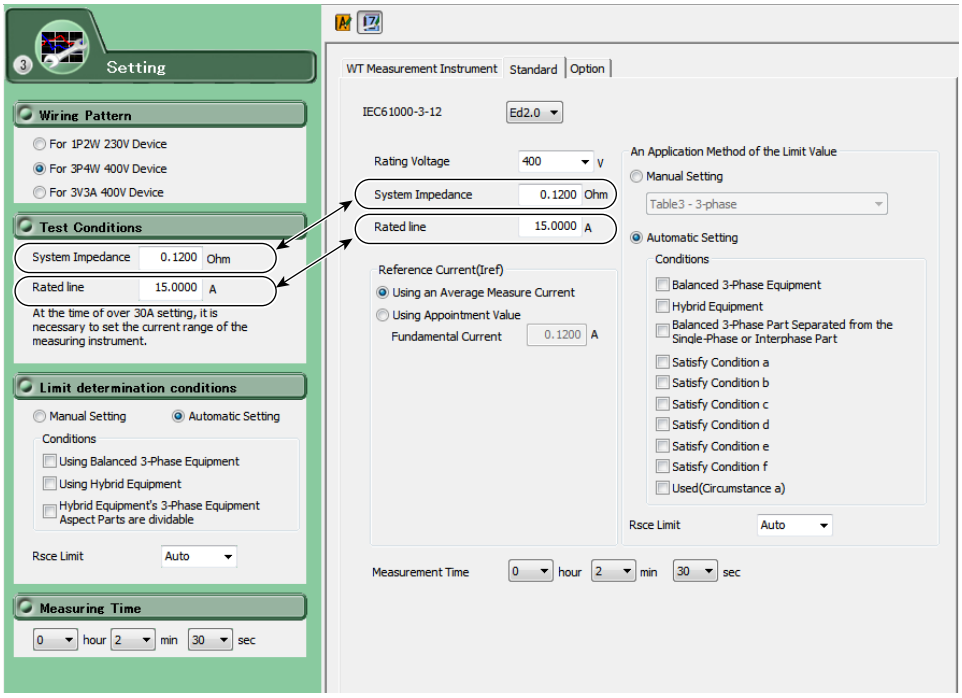
Setting Changes Based on Wiring Pattern Selection

When you select a wiring pattern in the Setting submenu, the settings marked off in the following figures change to their default values. The values in the figures are the default values.



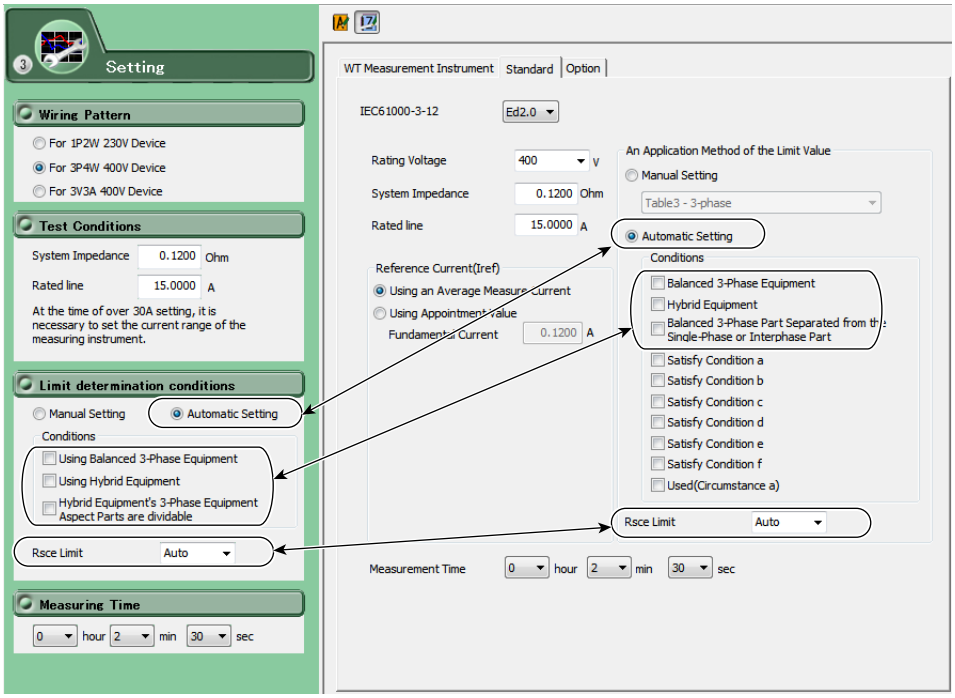
Setting Changes Based on Test Condition

When you set test condition in the Setting submenu, the settings marked off in the following figures change to their default values. The values in the figures are the default values.



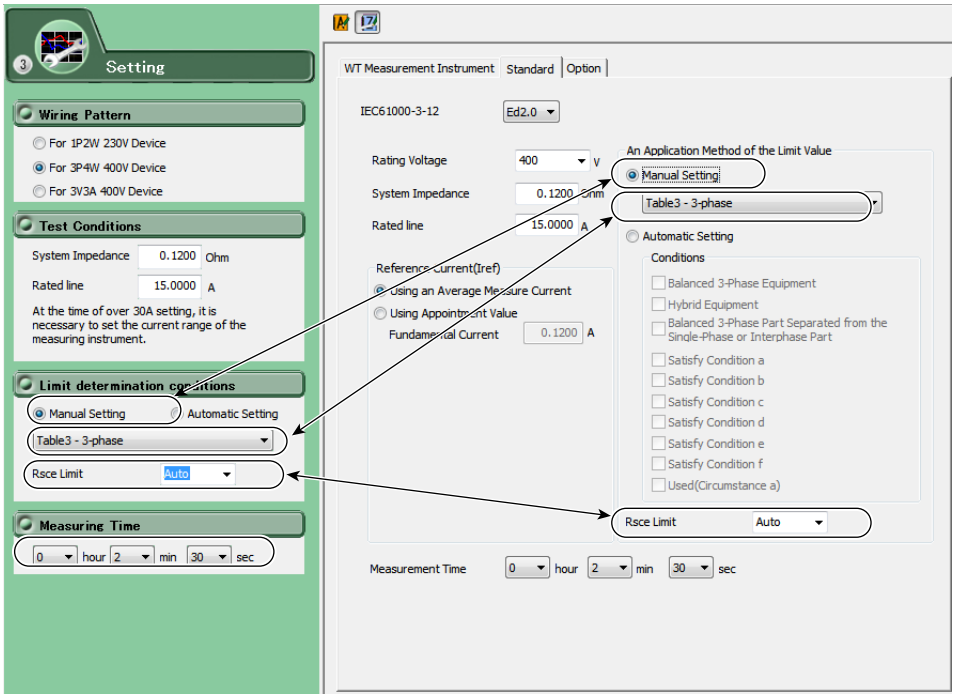
Setting Changes Based on Limit Determination Condition (Automatic Setting)

When you set limit determination condition in the Setting submenu, the settings marked off in the following figures change to their default values. The values in the figures are the default values.



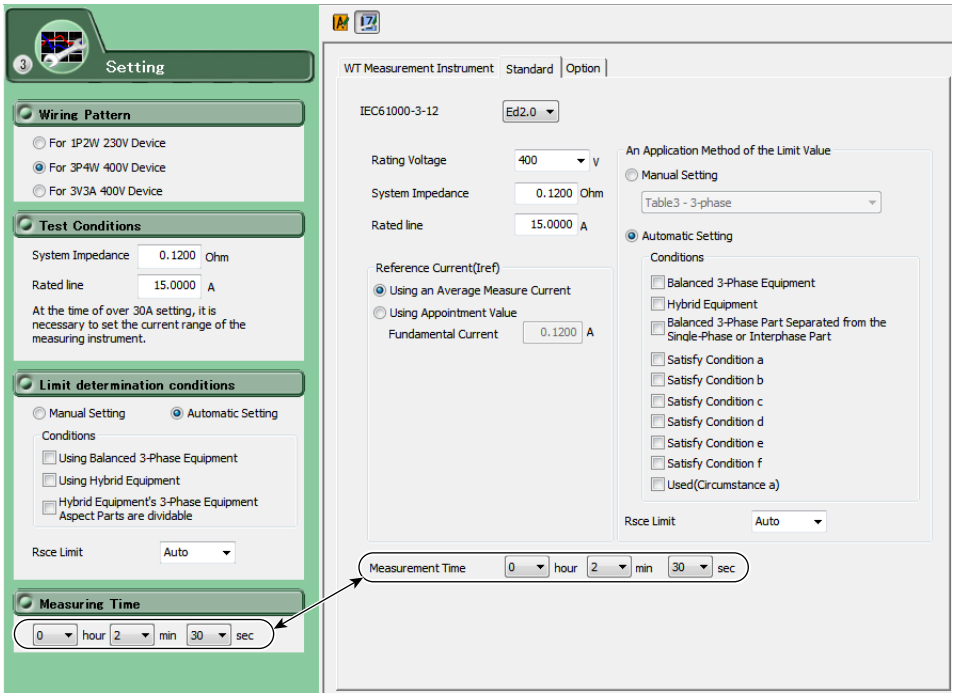
Setting Changes Based on Limit Determination Condition (Manual Setting)

When you set limit determination condition in the Setting submenu, the settings marked off in the following figures change to their default values. The values in the figures are the default values.



Setting Changes Based on Measuring Time Setting)

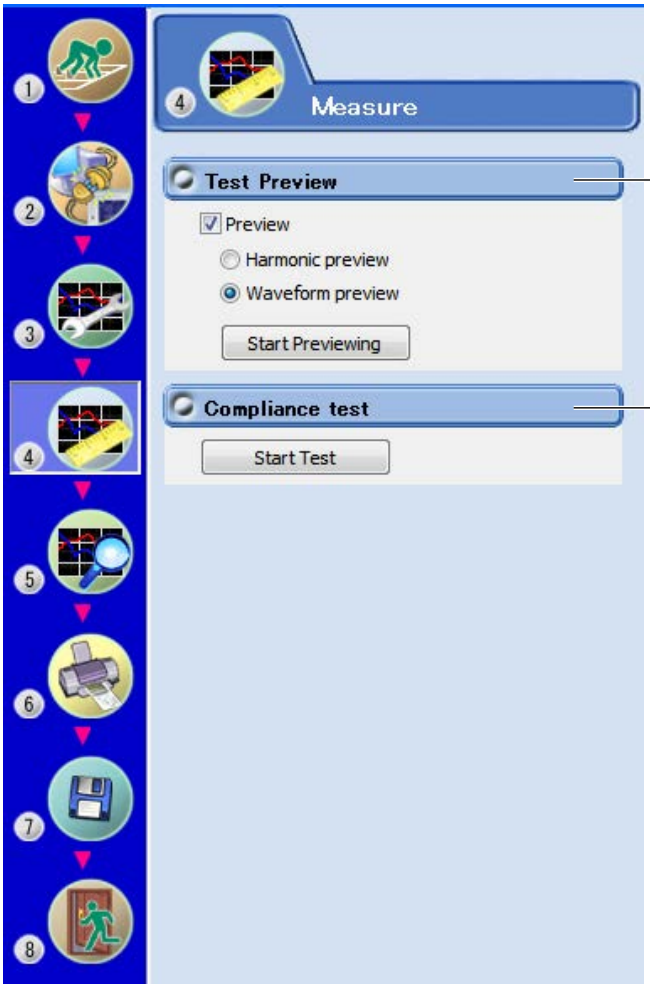
When you set Measuring time in the Setting submenu, the settings marked off in the following figures change to their default values. The values in the figures are the default values.



8.1 Previewing Harmonic Data and Waveform Data

Procedure

1. Select the icon in the menu area. The Measure submenu appears.



Test preview (page 8-2)
Before you start a test, you can check harmonic measurement data and waveform data. You can execute a compliance test without previewing data.

Compliance test (page 8-6)
Executes a compliance test based on harmonic measurement.

An Example of the Setting and Display Area during a Preview

Sampled data count
When a preview is being displayed, the display here is 0/0. When a compliance test is being executed, the number of times measured data has been acquired is displayed (for details, see section 8.2).

Measure time
When a preview is being displayed, the display here is 0.0sec/[the measurement time set according to the procedure described in chapter 7]. When a compliance test is being executed, the amount of time for which measured data has been acquired is displayed (for details, see section 8.2).

Select the element whose data you want to display.

Window arrangement buttons
For details, see chapter 12.

Displays cascaded windows

Displays tiled windows

Harmonic order (1 to 40)

Rms voltage values for each harmonic order

Rms current values for each harmonic order

The current phase angle of each harmonic order relative to the fundamental current
However, the phase angle shown in the line for order 1 (-4.4747° in this example) is the phase angle of the fundamental current waveform relative to the fundamental voltage waveform.

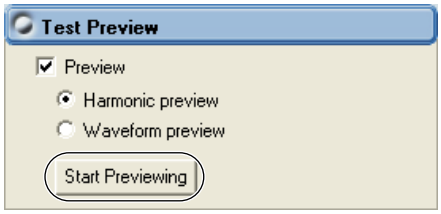
Order	Voltage	Current	Phase
1	230.186	13.8732	- 4.4747
2	0.0277	0.0206	-94.6372
3	3.1636	5.0387	170.262
4	0.0208	0.0063	-118.656
5	5.4854	1.2472	-171.735
6	0.0235	0.0093	91.3273
7	2.2452	0.9784	6.9767
8	0.0185	0.0057	47.3793
9	0.4880	0.3957	-52.7498
10	0.0140	0.0071	-105.601
11	0.8930	0.1499	-131.705
12	0.0174	0.0053	-160.417
13	0.4925	0.3700	82.6431
14	0.0170	0.0064	1.7870
15	0.2910	0.0464	-173.547
16	0.0161	0.0057	5.6686
17	0.6562	0.2766	-106.981
18	0.0120	0.0054	-179.014
19	0.5967	0.1108	116.876
20	0.0140	0.0060	179.287
21	0.1280	0.1697	64.2518
22	0.0161	0.0064	-50.3850
23	0.4028	0.2403	-25.6921
24	0.0147	0.0058	101.477
25	0.3872	0.0665	-70.5317
26	0.0122	0.0063	78.4688
27	0.1727	0.2379	164.251
28	0.0156	0.0073	-79.6418

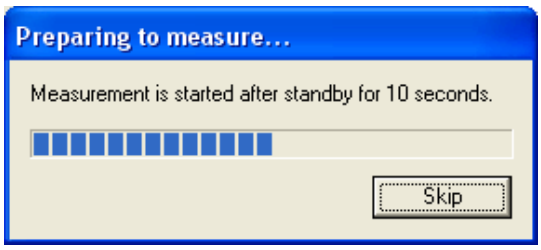
Element	1	**Input element**
An Application Limit Value	balanced 3-phase equipment.	**Application Limit[1]**
Range	300V/30A	
Frequency	50.029Hz	**The fundamental frequency of the PLL source**
Voltage(rms)	230.29V	
Current(rms)	14.8650A	
PowerP	3178.56W	
PowerS	3423.27VA	
PF	0.9285	
Sigma W	3178.56W	**Active power of all phases[2]**
THC	5.34%	**Total harmonic current**
V THD	3.00%	**Voltage harmonic distortion factor**
A THD	38.48% / 38.48%	**Current harmonic distortion factor**
P THD	0.16%	**Power harmonic distortion factor**
Phi5	210.64	**Phase angle of the 5th harmonic**
PWHD	18.65%	**Partial weighted harmonic distortion**
I1	-----	**Reference fundamental current[3]**
Min Rsce	-----	**Minimum short circuit ratio[3]**
Power Rsce	-----	**Power supply short circuit ratio[3]**

1 If you set the conditions for applying limits to auto, the limit values are not displayed in the preview or when a compliance test is executed.
2 Sigma W is the active power for all grouped phases (all measured input elements).
3 Values are not displayed during a preview or compliance test. Values appear on the Analysis page (chapter 8).

Previewing Harmonic Data

2. Select the **Preview** check box.
3. Select **Harmonic preview**.
4. Click **Start Previewing**.



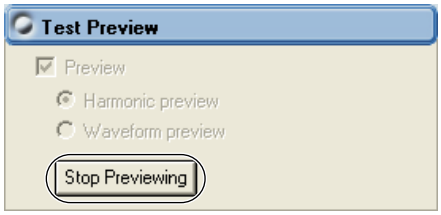


Note

When you preview the harmonics of a current, the data that had been acquired or loaded before the preview is discarded. Be sure to save any compliance test data before you begin a harmonic preview (for information on how to save data, see chapter 11).

Stopping a Harmonic Preview

Click **Stop Previewing**.

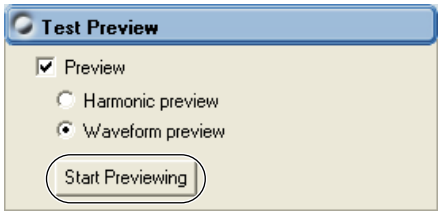


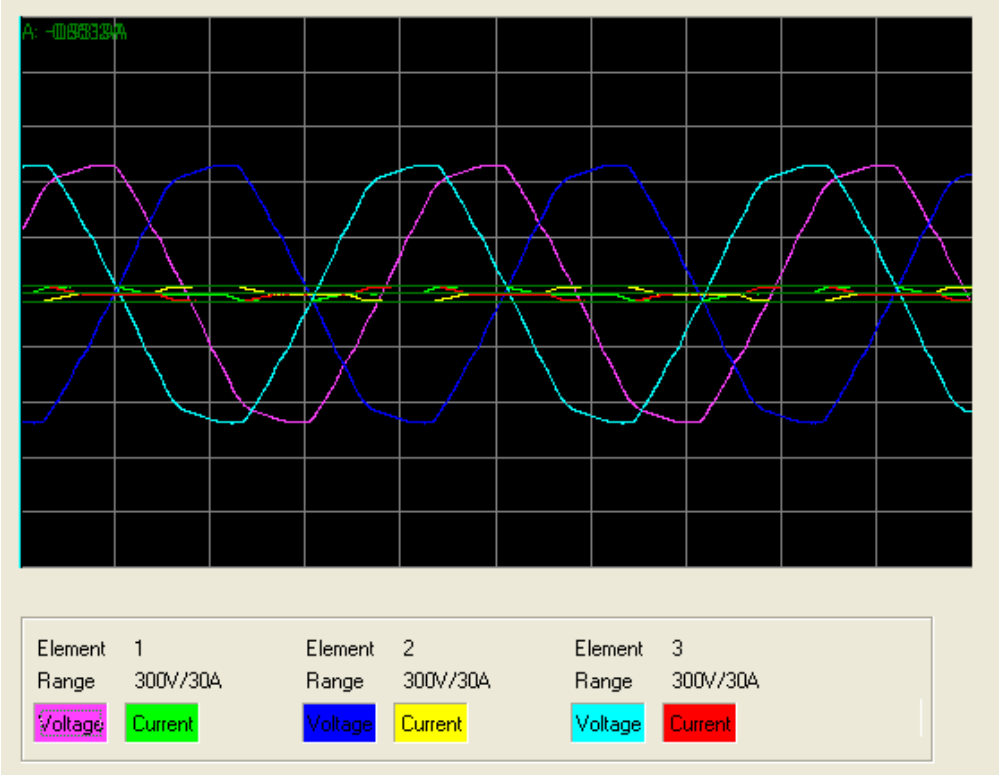
Selecting the Element Whose Data You Want to Display

Click . If input elements 1 to 3 are being measured, as you click the icon, the displayed data will switch from element 1, to element 2, to element 3, to element 1, and so on. Click ▼ to select an element directly.

Previewing Waveforms

2. Select the **Preview** check box.
3. Select **Waveform preview**.
4. Click **Start Previewing**. Voltage and current waveform previews appear in the waveform observation window.





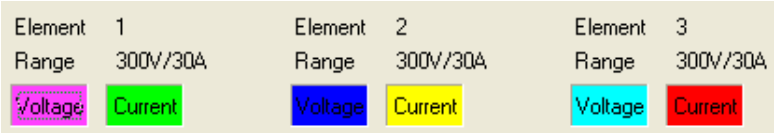
Note

When you preview waveforms, the data that had been acquired or loaded before the preview is lost. Be sure to save any compliance test data before you begin a waveform preview (for information on how to save data, see chapter 11).

Showing/Hiding Specific Waveforms

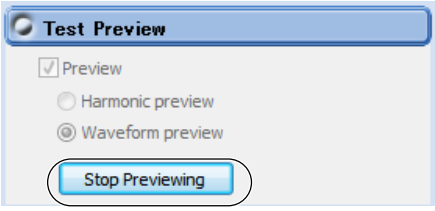
You can show or hide an element's voltage or current waveform by clicking on the Voltage and Current buttons for each element in the show/hide box.

Show/hide box



Stopping a Waveform Preview

Click **Stop Previewing**.



Explanation

Changing the Y-Axis Scale (the Size of the Voltage and Current Waveforms)

- Linear scaling is used. Logarithmic scaling is not supported.
- The measurement range specified for the WT is used as the maximum value, 1.0, on the Y-axis (see section 7.2 for details on setting the range).

Display Colors

The following colors are assigned to the waveforms of each input element in order, starting with the lowest numbered element. If you are previewing the waveforms of elements 1, 2, and 3, the following colors will be assigned to the element's voltage and current waveforms:

Element	Voltage Waveform	Current Waveform
Element 1	Pink	Bright green
Element 2	Blue	Yellow
Element 3	Turquoise	Red

* The colors and corresponding names are the same as those in Microsoft Word and Microsoft Excel.

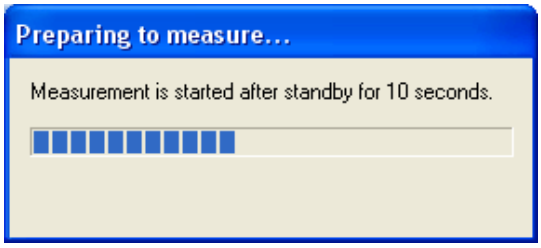
8.2 Making Harmonic Measurements

Procedure

1. Select the icon in the menu area. The Measure submenu appears. For general information about the Measure submenu, see section 8.1.

Starting a Test

2. Click **Start Test**. A dialog box opens that indicates that you have to wait before measurement starts. Then measured harmonic values appear in the measured harmonic values list window.



Stopping a Test

- **Stopping Automatically**
  The software will stop testing automatically once the specified measurement time has been reached.

- **Stopping Manually**
  Click **Stop Test**. If the WT is measuring, it will stop when measurement ends normally and data has been acquired.

An Example of the Setting and Display Area during a Compliance Test

Sampled data count
One sample count is equivalent to 200 ms (10 waves for 50 Hz and 12 waves for 60 Hz) worth of measured instantaneous data values. This data is acquired by the software and displayed. In this example, 145 samples have been acquired.

Measure time
The amount of time that has elapsed since the start of measurement/the measurement time set according to the procedure described in chapter 7.

Select the element whose data you want to display.

Window arrangement buttons
For details, see chapter 12.

Displays cascaded windows

Displays tiled windows

Harmonic order (1 to 40)

Rms voltage values for each harmonic order

Rms current values for each harmonic order

The current phase angle of each harmonic order relative to the fundamental current
However, the phase angle shown in the line for order 1 (-4.4747° in this example) is the phase angle of the fundamental current waveform relative to the fundamental voltage waveform.

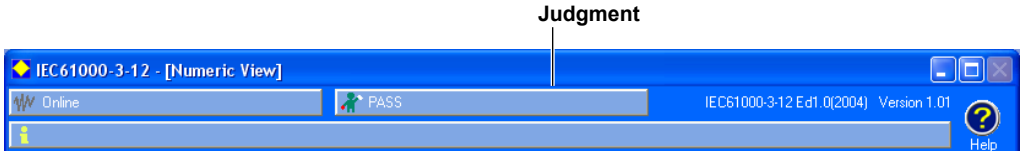
Order	Voltage	Current	Phase
1	230.186	13.8732	- 4.4747
2	0.0277	0.0206	-94.6372
3	3.1636	5.0387	170.262
4	0.0208	0.0063	-118.656
5	5.4854	1.2472	-171.735
6	0.0235	0.0093	91.3273
7	2.2452	0.9784	6.9767
8	0.0185	0.0057	47.3793
9	0.4880	0.3957	-52.7498
10	0.0140	0.0071	-105.601
11	0.8930	0.1499	-131.705
12	0.0174	0.0053	-160.417
13	0.4925	0.3700	82.6431
14	0.0170	0.0064	1.7870
15	0.2910	0.0464	-173.547
16	0.0161	0.0057	5.6686
17	0.6562	0.2766	-106.981
18	0.0120	0.0054	-179.014
19	0.5967	0.1108	116.876
20	0.0140	0.0060	179.287
21	0.1280	0.1697	64.2518
22	0.0161	0.0064	-50.3850
23	0.4028	0.2403	-25.6921
24	0.0147	0.0058	101.477
25	0.3872	0.0665	-70.5317
26	0.0122	0.0063	78.4688
27	0.1727	0.2379	164.251
28	0.0156	0.0073	-79.6418

Element	1	**Input element**
An Application Limit Value	balanced 3-phase equipment.	**Application Limit[1]**
Range	300V/30A	
Frequency	50.029Hz	**The fundamental frequency of the PLL source**
Voltage(rms)	230.29V	
Current(rms)	14.8650A	
PowerP	3178.56W	
PowerS	3423.27VA	
PF	0.9285	
Sigma W	3178.56W	**Active power of all phases[2]**
THC	5.34%	**Total harmonic current**
V THD	3.00%	**Voltage harmonic distortion factor**
A THD	38.48% / 38.48%	**Current harmonic distortion factor**
P THD	0.16%	**Power harmonic distortion factor**
Phil5	210.64	**Phase angle of the 5th harmonic**
PWHD	18.65%	**Partial weighted harmonic distortion**
I1	-----	**Reference fundamental current[3]**
Min Rsce	-----	**Minimum short circuit ratio[3]**
Power Rsce	-----	**Power supply short circuit ratio[3]**

1 If you set the conditions for applying limits to auto, the limit values are not displayed in the preview or when a compliance test is executed.
2 Sigma W is the active power for all grouped phases (all measured input elements).
3 Values are not displayed during a preview or compliance test. Values appear on the Analysis page (chapter 8).

Judgment Display

Once the test is finished, the overall judgment appears in the information area.



If all of the elements that are tested pass, PASS appears. Otherwise, FAIL appears.

PASS

FAIL

NoData

Explanation

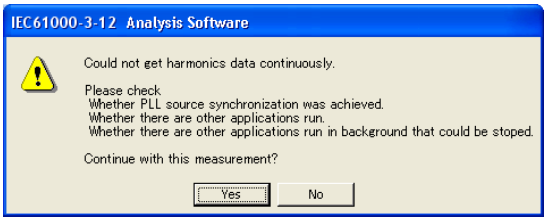
Judgments

PASS will appear in the following circumstances. Confirm the minimum measured R_{sce} from the Analysis page (see chapter 8 for details).

- The equipment passed with the limit for R_{sce}=33.
- The equipment did not pass with the limit for R_{sce}=33, but it did pass with the limit for the minimum R_{sce} that was calculated based on measurements.
- The equipment did not pass with the limit for Rsce=33, but it did pass with the limit for the specified minimum R_{sce}.

Error Messages during Measurement

The following error message may appear when measurement is executed in Harmonic Measurement mode.



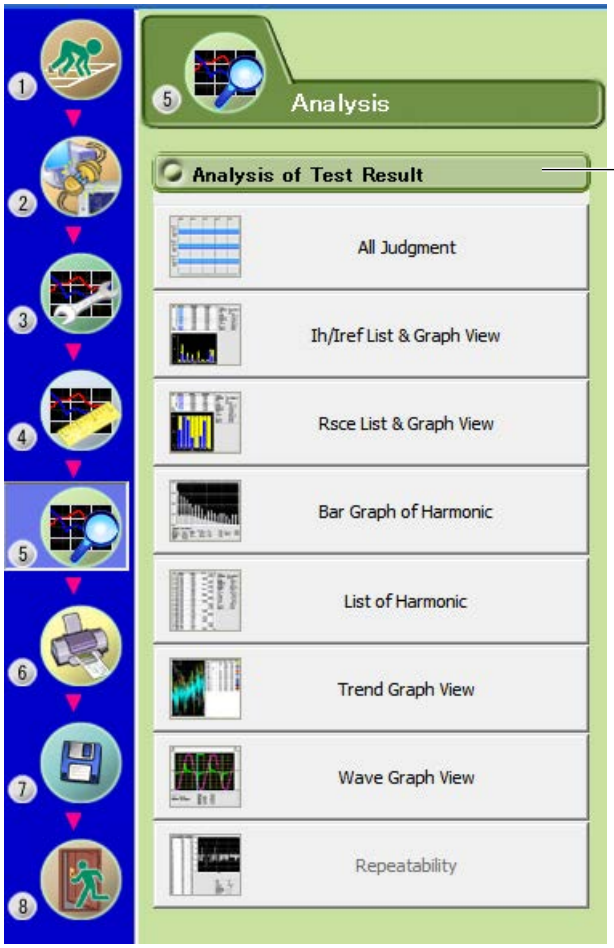
This software retrieves large amount of measured data from the WT. The error message may appear if the CPU on the PC is overloaded and cannot keep up with the data transfer. Lighten the load placed on the CPU on the PC by checking the points listed below.

- Do not operate or run other programs.
- Close memory-resident programs (turn them OFF).
- Disable the standby mode.
- Use the software on a PC that satisfies the system requirements given in section 1.2.

9.1 Displaying a Graph of All Judgments

Procedure

1. Select the icon in the menu area. The Analysis submenu appears.



Analysis of test results
Measured data can be displayed in the following formats:

- Graph of all judgments (page 9-2)
- List and graph of Ih/Iref values (page 9-7)
- List and graph of Rsce values (page 9-12)
- Bar graph of harmonic data (page 9-15)
- List of measured harmonic values (page 9-17
- Trend graph (page 9-18)
- Waveform graph (page 9-22)
- Repeatability (chapter 5.2)

Window arrangement buttons
For details, see chapter 12.

Displays cascaded windov

Displays tiled windows

Loss of Measured Data

While in the Analysis window, if you click the Measure icon and switch to the Measure window, the measured data will be discarded. Save the data if you do not want it to be discarded (see chapter 11 for information on how to save data).

Displaying a Graph of All Judgments

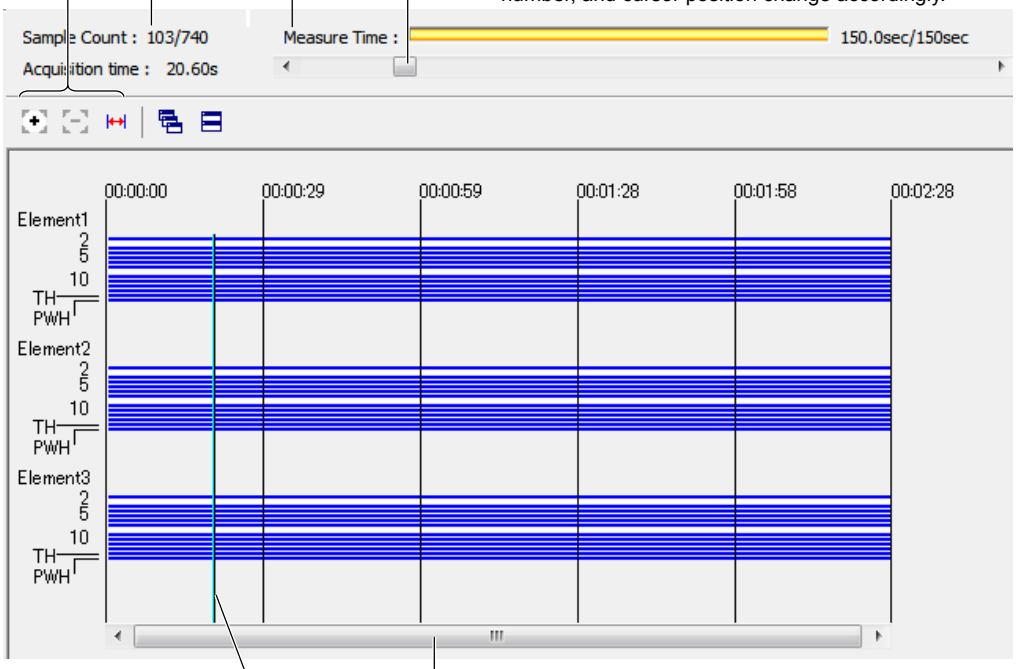
2. Click **All Judgment**. A graph of all judgments appears.

Zoom in/zoom out/display all (page 9-4)

Sampled data count

Measure time

Scroll bar
You can drag (the slider) with the mouse or click to select the measured data that you want to display. When you move the slider, the measure time, sample count number, and cursor position change accordingly.



Cursor (page 9-4).

Display range bar
This bar indicates where the currently displayed period of time is within the measurement time.

Judgment graph
This graph shows the judgment results for all data within the measurement time. The judgments for each element are displayed in different colors, depending on the judgment results. The judgment results that are displayed here will change if you shift the displayed time range using the display range bar.

Explanation

The software displays a graph that shows whether each of the values for Ih/Iref that are measured within the specified measurement time are within their limits according to the settings described in section 7.3, “Setting the WT3000 Judgment Conditions.”

The input elements that are measured vary depending on the Wiring Pattern setting (see chapter 7 for details). The software makes judgments for every input element that is set in the Wiring Pattern setting.

Evaluation Colors

The meaning of the evaluation colors indicated in the evaluation graph is shown in the following table. Below are the conditions of Condition 1 and Condition 2.

- **Condition 1**
  The maximum harmonic current over the measurement time is within 1.5 times the specified limit. Evaluation is made on each order.

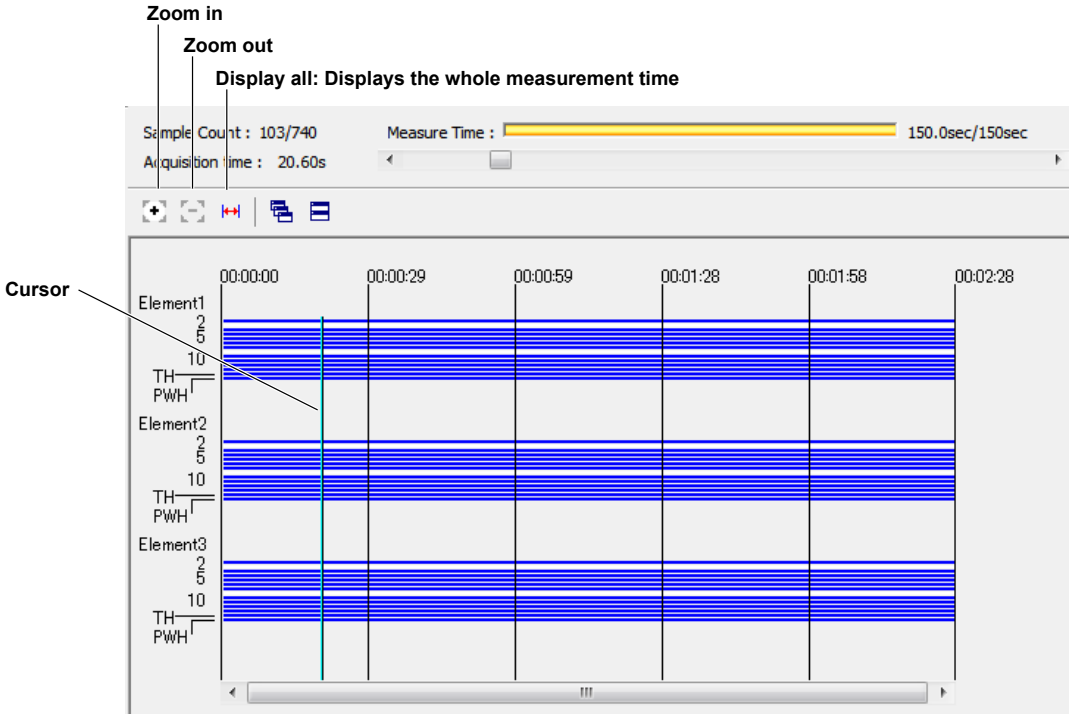
- **Condition 2**
  The mean harmonic current over the measurement time is within the specified limit. Evaluation is made on each order.

Blue	Both conditions 1 and 2 are met.
White	A limit has not been specified.
Yellow	• Condition 1 is met. • Condition 2 is not met.
Orange	• Condition 1 is not met. • Condition 2 is met.
Red	Neither condition 1 or 2 is met.

* The colors and corresponding names are the same as those in Microsoft Word and Microsoft Excel.

If the display of the measured data within the measurement time only contains blue, white, and turquoise, the overall judgment result will be PASS. If any of the data within the measurement time is yellow, orange, or red, the displayed judgment result will be FAIL.

Zooming In and Out



The Zoom In and Zoom Out Icons

Each time you click one of the zoom icons, the software will zoom in or zoom out from the cursor. The zoom levels are:

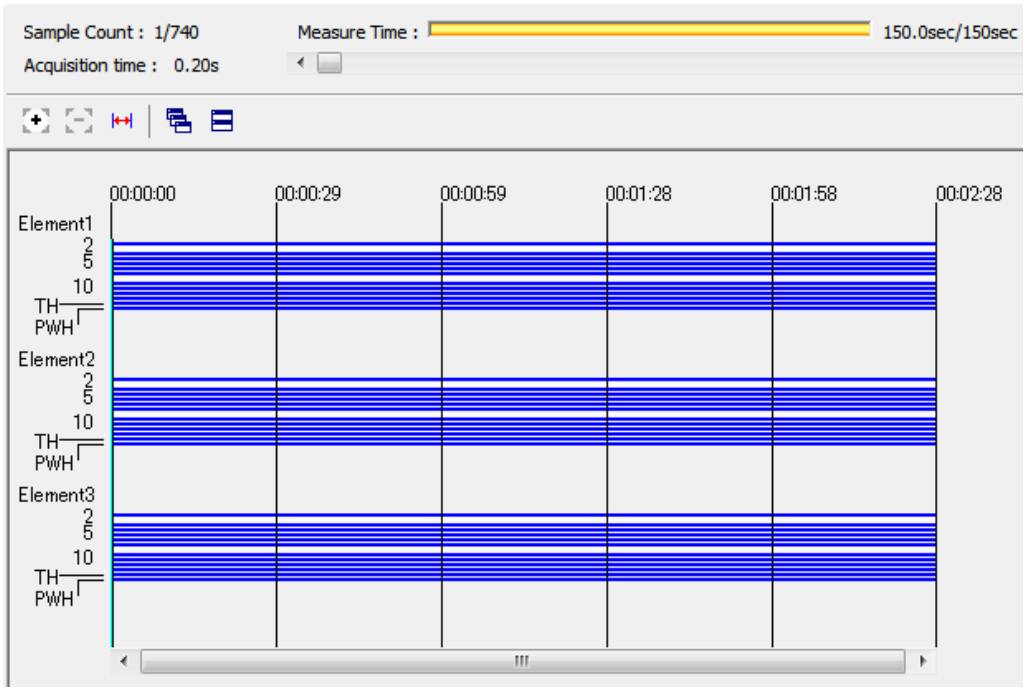
25 s
50 s
100 s (1 min 40 s)
200 s (3 min 20 s)
400 s (6 min 40 s)
800 s (13 min 20 s)
1600 s (26 min 40 s)
3200 s (53 min 20 s)
⋮
The entire measurement time

If a zoom out would cause the zoomed display to show more than 75% of the measurement time, the entire measurement time will be displayed. For example, if the measurement time is 1 h, the 3200 s (53 min 20 s) level will not be displayed because it would show 89% of the entire measurement time.

Using the Graph of All Judgments Effectively

You can select specific measured data that you want to examine more closely on the graph of all judgments to display bar graphs and lists of the measured data. The following example shows how to display an I_n/I_1 list and bar graph for element 1.

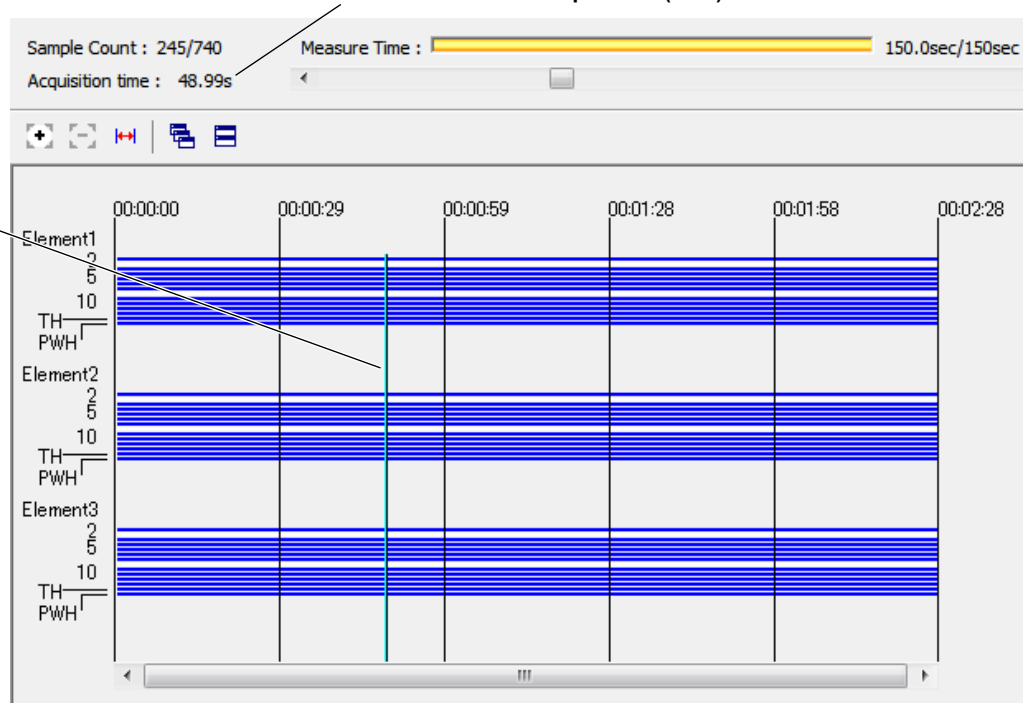
1. Use the mouse to click the appropriate area. The cursor will shift to the time position that you click.



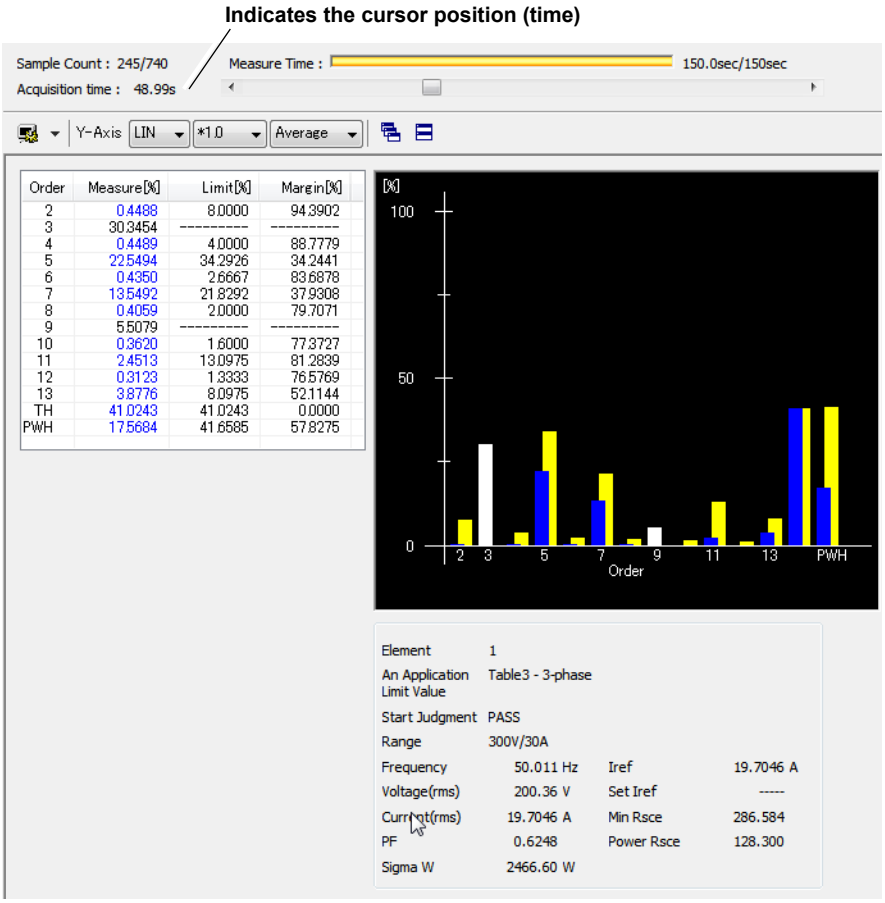
The cursor moves to the point (time) that you click on.

Indicates the cursor position (time)

Cursor



2. In the submenu, select Ih/Iref ListGraph View, and then select Instant from the list in the setting and display area. A bar graph for the instantaneous values from the cursor position will appear.
For detailed information about the bar graph display, see section 9.4.



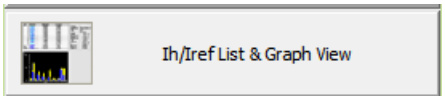
9.2 Displaying a List and Graph of I_h/I_{ref} Values

Procedure

1. Select the icon in the menu area. The Analysis submenu appears. For general information about the Analysis submenu, see section 9.1.

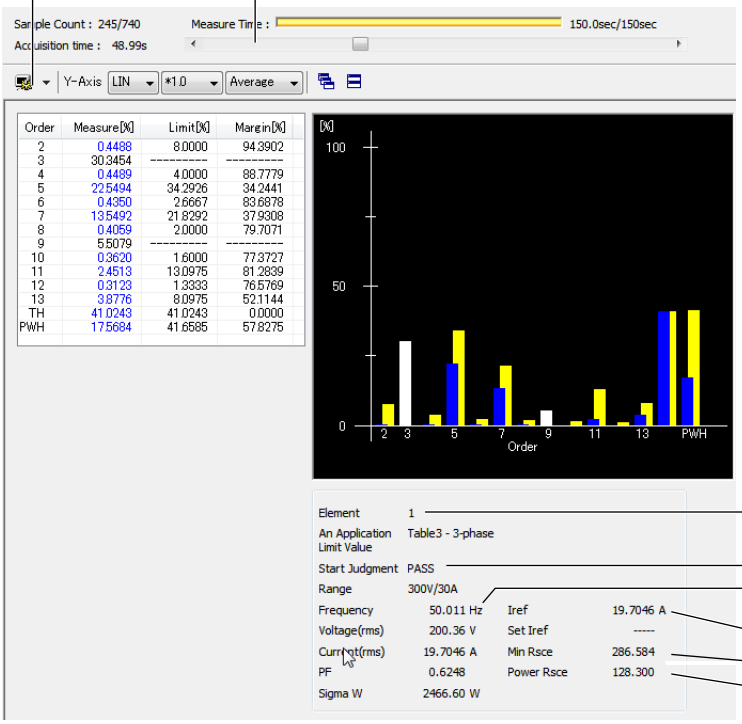
Displaying a List and Graph of I_h/I_{ref} Values

2. Click **Ih/Iref ListGraph View**. A list and graph of I_h/ref values appear.



Select the element whose data you want to display.

Scroll bar
When displaying instantaneous values, you can drag ⬜ (the slider) with the mouse or click ◀ ▶ to select the measured data that you want to display. When you move the slider, the measure time, sample count number, and displayed measured data (instantaneous values) change accordingly.

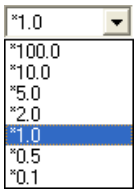


Input element
Element judgment
The fundamental frequency of the PLL source
Reference fundamental current
Minimum short circuit ratio
Power supply short circuit ratio

Selecting the Y-Axis (Current Magnitude) Scale

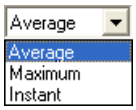
- **Selecting the Type of Y-Axis Scale**
  Select LIN (linear) or LOG (logarithmic).

- **Selecting the Magnification**
  When the type of scale is LIN, select *100.0, *10.0, *5.0, *2.0, *1.0, *0.5, or *0.1.
  When the type of scale is LOG, select *100.0, *10.0, *1.0, or *.1.



Selecting Average, Maximum, or Instantaneous Values

Select Average, Maximum, or Instant.



Selecting the Element Whose Data You Want to Display

Click . If input elements 1 to 3 are being measured, as you click the icon the displayed data will switch from element 1, to element 2, to element 3, to element 1, and so on. Click ▼ to select an element directly.

Explanation

List Display

Measured Value (%)

The software calculates the measured current values for each harmonic order using the following formula:

$$\frac{I_h}{I_{ref}} \times 100$$

I_h: Harmonic current component
I_{ref}: Reference current

Limit (%)

The software calculates the limits according to the standard based on the settings described in chapter 7.

Margin

Indicates the margin to the limit. For each order, the margin is derived from the following equation using the limits and measured values displayed in the list.

$$\frac{\text{Limit} - \text{measured value}}{\text{Limit}} \times 100$$

Bar Graph Display

Average/Maximum/Instantaneous Value

The software displays bar graphs and lists in three ways depending on whether you select to display average, maximum, or instantaneous values. This section explains the differences between each display.

- **Average value display**
  - Values and bars for each harmonic order
    The software averages the measured data (instantaneous values) of each harmonic order that is acquired within the measurement time and displays those averages.
  - Measured items that appear to the right of the list
    The software averages the values acquired for each measured item within the measurement time and displays those averages.
  - Limit values and bars
    The software displays numbers and yellow bars that indicate the values of the limits.

- **Maximum value display**
  - Values and bars for each harmonic order
    The software finds and displays the maximum value from each harmonic order's measured values by comparing the instantaneous values that have been acquired within the measurement time.
  - Items that appear to the right of the list
    The software finds and displays the maximum value for each measured item by comparing the instantaneous values that have been acquired within the measurement time.
  - Limit values and bars
    The software displays numbers and yellow bars that are 1.5 times greater than the values of the limits.

- **Instantaneous value display**
  - Values and bars for each harmonic order
    The software displays the instantaneous values acquired within the measurement time for each harmonic order.
  - Measured items that appear to the lower right of the list
    The software displays the instantaneous values acquired within the measurement time.
  - Limit values and bars
    The software displays numbers and yellow bars that are 1.5 times greater than the values of the limits.
  - Selecting values
    Use the scroll bar to change the displayed instantaneous values.

Note

When the software is displaying average or maximum values, using the scroll bar will have no effect on the I_h/I_{ref} list and graph displays.

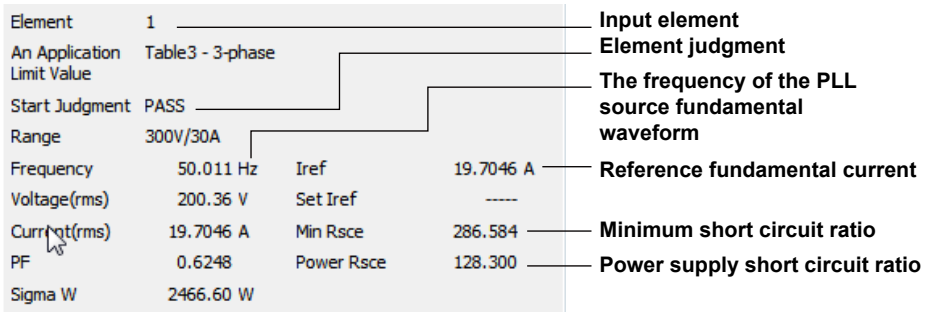
Bar Display Colors

The lengths for the bar graphs are determined by the size of the measured data that they represent. The meanings of bar colors are as follows:

Blue	Does not exceed the limit.
Red	Exceeds the limit.
White	A limit has not been specified.
Yellow	The limit specified by the standard.

* The colors and corresponding names are the same as those in Microsoft Word and Microsoft Excel.

Items that appear to the right of bar graphs.



Element Judgment

If the software returns a PASS judgment for each item in the currently displayed element, PASS appears here. Otherwise FAIL appears.

PASS will appear in the following circumstances. Confirm the minimum measured R_{sce}.

- The equipment passed with the limit for R_{sce}=33.
- The equipment did not pass with the limit for R_{sce}=33, but it did pass with the limit for the minimum R_{sce} that was calculated based on measurements.
- The equipment did not pass with the limit for Rsce=33, but it did pass with the limit for the specified minimum Rsce.

Minimum R_{sce} (Minimum Short Circuit Ratio)

See the explanation under "R_{sce} Limit (Minimum R_{sce})" in section 9.3.

S_{sc} (Short Circuit Power)

Corresponds to the minimum R_{sce}, which is calculated based on measurement.

Power Supply R_{sce} (Power Supply Short Circuit Ratio)

The short circuit ratio of the power supply of the testing device. According to the standard, the relationship between the minimum R_{sce} and the power supply R_{sce} must be as described below. Confirm that the results are in compliance with the standard.

- Equipment other than balanced three-phase equipment
  Minimum R_{sce} < Power supply R_{sce}
- Balanced three-phase equipment
  Minimum R_{sce} < Power supply R_{sce}
- Balanced three-phase equipment under specified conditions
  Minimum R_{sce} × 1.6 < Power supply R_{sce}

Graph Window-List Window Correspondence

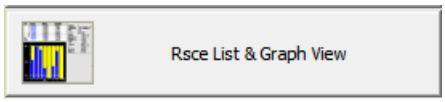
When you use the scroll bar to display the measured data at a specific acquisition time in one window, the measured data at the same acquisition time is also displayed in the other window.

9.3 Displaying a List and Graph of R_{sce} Values

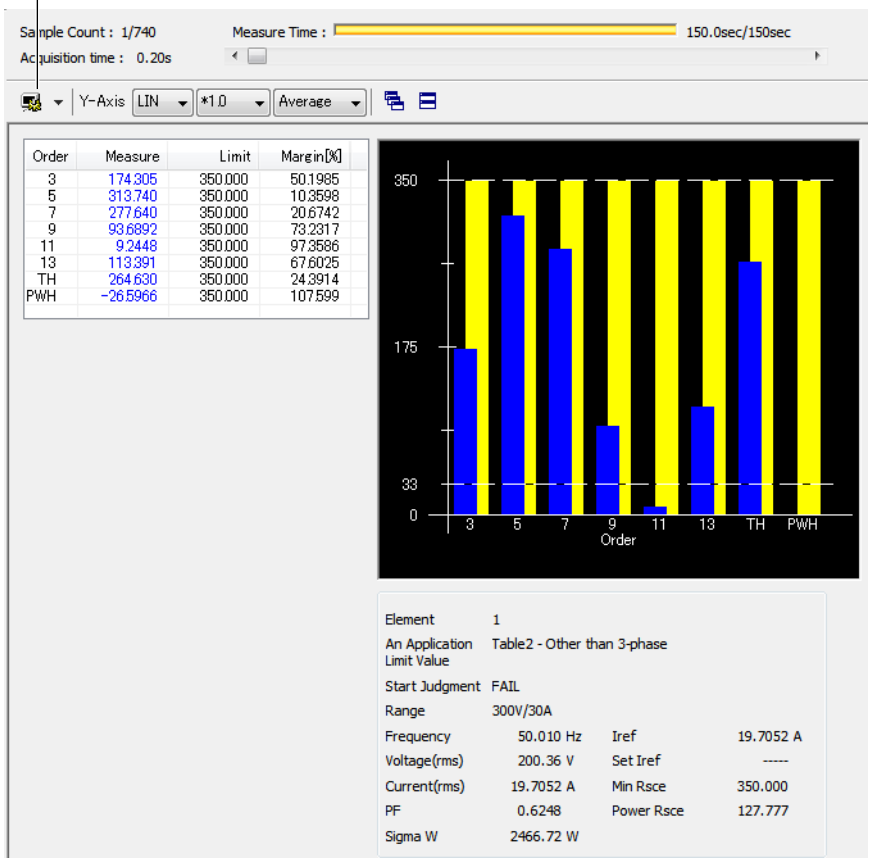
1. Select the icon in the menu area. The Analysis submenu appears. For general information about the Analysis submenu, see section 9.1.

Displaying a List and Graph of R_{sce} Values

2. Click **Rsce List&Graph View**. A list and graph of R_{sce} values appear.



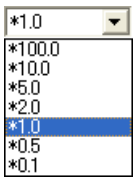
Select the element whose data you want to display.



Changing the Y-Axis Scale (the Size of the Current Waveform)

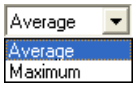
- **Selecting the Type of Y-Axis Scaling**
  Select **LIN** (linear) or **LOG** (logarithmic).

- **Selecting the Scale**
  When the scaling type is LIN, you can select ***100.0**, ***10.0**, ***5.0**, ***2.0**, ***1.0**, ***0.5**, or ***0.1.**
  When the scaling type is LOG, you can select ***100.0**, ***10.0**, ***1.0**, or ***0.1**.



Selecting to Display Average or Maximum Values

Select Average or Maximum.



Explanation

List Display

Measured Values

For each harmonic order, the measured values of R_{sce} are calculated based on the measured data according to linear interpolation.

R_{sce} Limit (Minimum R_{sce})

The greatest value out of the three values listed below will be used to calculate the R_{sce} limit (minimum R_{sce}). For more details, see the standard.

- The value of I_h/I_{ref} for each harmonic order (average)
- TH: THD/I_{ref}
- PWH: $PWHC/I_{ref}$

On the example on the previous page, the measured TH value of 286.585 is the greatest, so it is used as the limit for each measured value (minimum R_{sce}).

Margin

Indicates the margin to the limit. For each order, the margin is derived from the following equation using the limits and measured values displayed in the list.

$$\frac{\textbf{Limit – measured value}}{\textbf{Limit}} \times \textbf{100}$$

Bar Graph Display

Average/Maximum

The software displays bar graphs and lists in three ways depending on whether you select to display average, maximum, or instantaneous values. This section explains the differences between each display.

- **Average Value Display**
  - Values and bars for each harmonic order
    The software averages the measured data of each harmonic order acquired within the measurement time and displays those averages.
  - Measured items that appear to the right of the list
    The software averages the values acquired for each measured item within the measurement time and displays those averages.
  - Limit values and bars
    The software displays numbers and yellow bars that indicate the values of the limits.

- **Maximum Value Display**
  - Values and bars for each harmonic order
    The software finds and displays the maximum value from each harmonic order's measured values by comparing the instantaneous values that have been acquired within the measurement time.
  - Items that appear to the right of the list
    The software finds and displays the maximum value for each measured item by comparing the instantaneous values that have been acquired within the measurement time.
  - Limit values and bars
    The software displays numbers and yellow bars that are 1.5 times greater than the values of the limits.

Note

Using the scroll bar will have no effect on the R_{sce} list and bar graph displays.

Bar Display Colors

The lengths for the bar graphs are determined by the size of the measured data that they represent. The meanings of bar colors are as follows:

Blue	Does not exceed the limit.
Red	Exceeds the limit.
White	A limit has not been specified.
Yellow	The limit specified by the standard.

* The colors and corresponding names are the same as those in Microsoft Word and Microsoft Excel.

9.4 Displaying a Harmonic Bar Graph

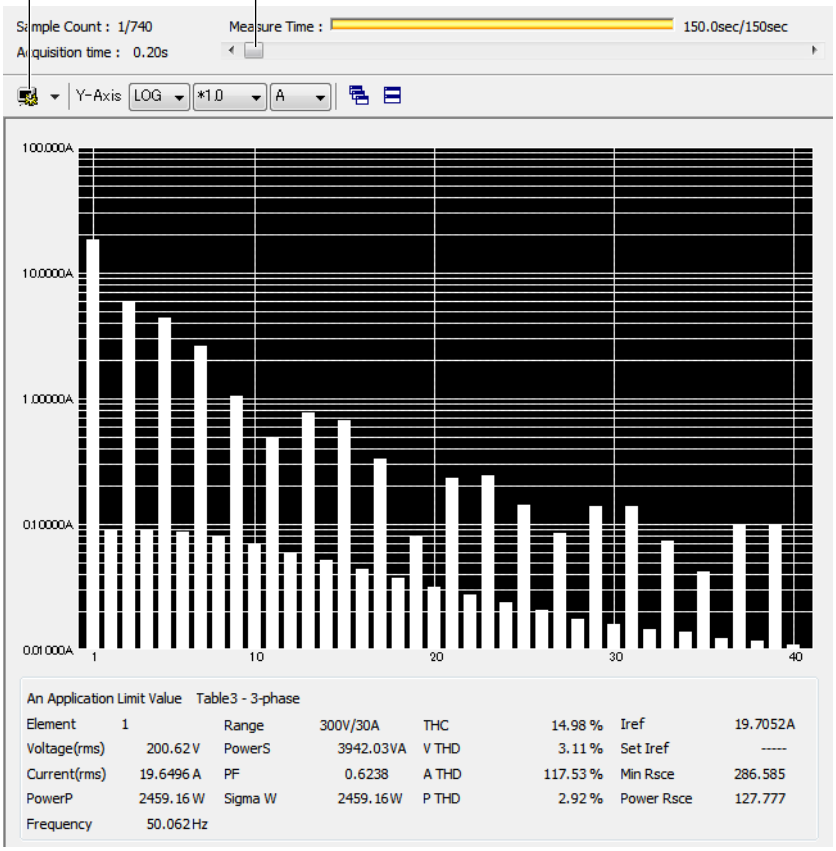
1. Select the icon in the menu area. The Analysis submenu appears. For general information about the Analysis submenu, see section 9.1.

Displaying a Harmonic Bar Graph

2. Click **Bar Graph of Harmonic**. A harmonic bar graph appears.

Select the element whose data you want to display.

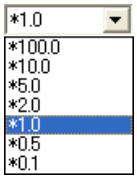
Scroll bar
You can drag (the slider) with the mouse or click to select the measured data that you want to display. When you move the slider, the measure time, sample count number, and displayed measured data (instantaneous values) change accordingly.



Changing the Y-Axis Scale (the Size of the Current Waveform)

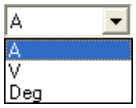
- **Selecting the Type of Y-Axis Scaling**
  Select **LIN** (linear) or **LOG** (logarithmic).

- **Selecting the Scale**
  When the scaling type is LIN, you can select ***100.0**, ***10.0**, ***5.0**, ***2.0**, ***1.0**, ***0.5**, or ***0.1.**
  When the scaling type is LOG, you can select ***100.0**, ***10.0**, ***1.0**, or ***0.1**.



Selecting the Measurement Function to Display

Select A, V, or Deg (for current, voltage, or phase angle).



Explanation

Bar Graph of Harmonic Current or Voltage

The software displays the instantaneous values acquired within the measurement time for each harmonic order.

Bar Graph of Harmonic Phase Angles

Bar graphs of the phase angle of the harmonic current with respect to the fundamental current for each order can be displayed. However, the phase angle with respect to the fundamental voltage is displayed on the bar graph for the fundamental current.

- When the harmonic phase is leading the fundamental current, a positive phase angle is indicated; when the harmonic phase is lagging the fundamental current, a negative phase angle is indicated.
- When the fundamental current is leading the fundamental voltage, a negative phase angle is indicated; when the fundamental current is lagging the fundamental voltage, a positive phase angle is indicated.

Bar Graph Display Color

The bar graph is displayed in white.

Note

This bar graph does not display limits, because there are no current, voltage, or phase angle limits.

Selecting Instantaneous Values

Use the scroll bar to change the displayed instantaneous values.

9.5 Displaying a List of Measured Harmonic Values

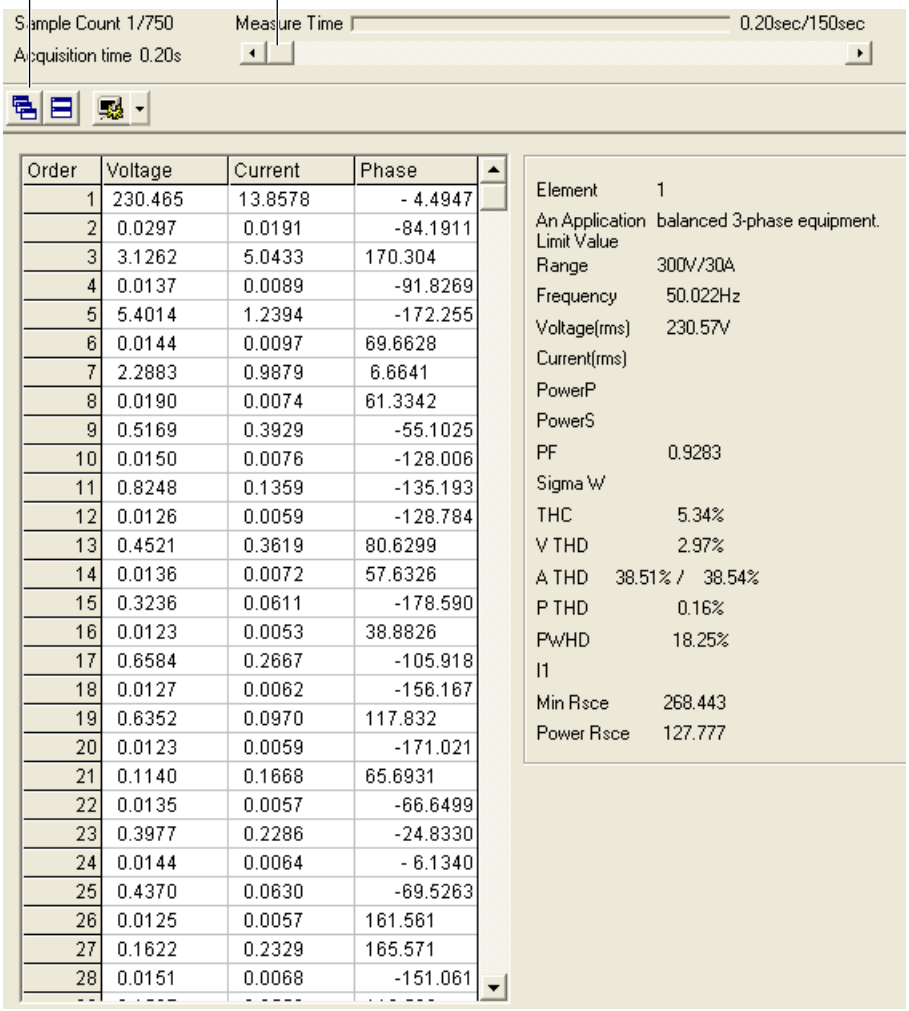
1. Select the icon in the menu area. The Analysis submenu appears. For general information about the Analysis submenu, see section 9.1.

Displaying a List of Measured Harmonic Values

2. Click **List of Harmonic**. A list of measured harmonic (instantaneous) values appears.

Select the element whose data you want to display.

Scroll bar
You can drag (the slider) with the mouse or click to select the measured data that you want to display. When you move the slider, the measure time, sample count number, and displayed measured data (instantaneous values) change accordingly.



Order	Voltage	Current	Phase
1	230.465	13.8578	- 4.4947
2	0.0297	0.0191	-84.1911
3	3.1262	5.0433	170.304
4	0.0137	0.0089	-91.8269
5	5.4014	1.2394	-172.255
6	0.0144	0.0097	69.6628
7	2.2883	0.9879	6.6641
8	0.0190	0.0074	61.3342
9	0.5169	0.3929	-55.1025
10	0.0150	0.0076	-128.006
11	0.8248	0.1359	-135.193
12	0.0126	0.0059	-128.784
13	0.4521	0.3619	80.6299
14	0.0136	0.0072	57.6326
15	0.3236	0.0611	-178.590
16	0.0123	0.0053	38.8826
17	0.6584	0.2667	-105.918
18	0.0127	0.0062	-156.167
19	0.6352	0.0970	117.832
20	0.0123	0.0059	-171.021
21	0.1140	0.1668	65.6931
22	0.0135	0.0057	-66.6499
23	0.3977	0.2286	-24.8330
24	0.0144	0.0064	- 6.1340
25	0.4370	0.0630	-69.5263
26	0.0125	0.0057	161.561
27	0.1622	0.2329	165.571
28	0.0151	0.0068	-151.061

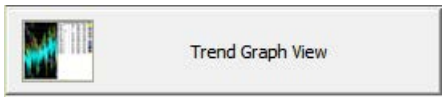
Element	1
An Application Limit Value	balanced 3-phase equipment.
Range	300V/30A
Frequency	50.022Hz
Voltage(rms)	230.57V
Current(rms)	
PowerP	
PowerS	
PF	0.9283
Sigma W	
THC	5.34%
V THD	2.97%
A THD	38.51% / 38.54%
P THD	0.16%
PWHD	18.25%
I1	
Min Rsce	268.443
Power Rsce	127.777

9.6 Displaying a Trend Graph

1. Select the icon in the menu area. The Analysis submenu appears. For general information about the Analysis submenu, see section 9.1.

Displaying a Trend Graph

2. Click **Trend Graph View**. A trend graph appears.



Configuring a Trend Graph

Auto range
- **When the auto range button is pressed**
  The range changes automatically to match the loaded data.
- **When the auto range button is not pressed**
  When you click the Upper or Lower column headings, a combo box appears that allows you to set the display range upper and lower limits for each trace.

Grid
You can select the type of grid that will be displayed in the trend display area from Dotted, Line, and None.
• Dotted: A grid with dotted lines is displayed.
• Line: A grid with solid lines is displayed.
• None: No grid is displayed.

Zoom in/zoom out (page 9-21)

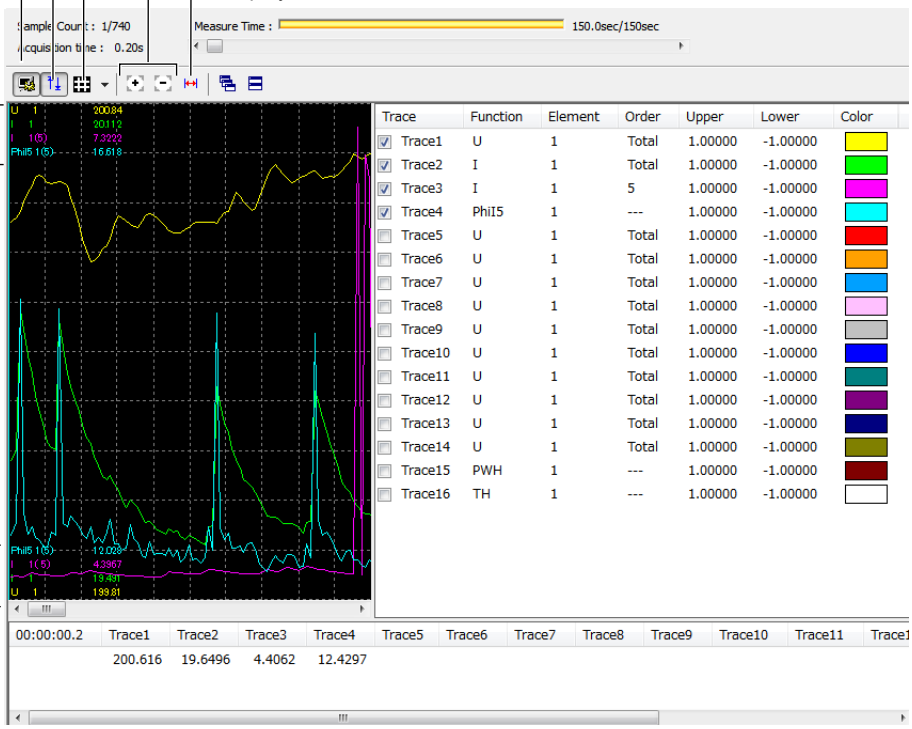
Tortal Indication
Display the waveform in the all measure time

Show/hide trace settings box (page 9-19)

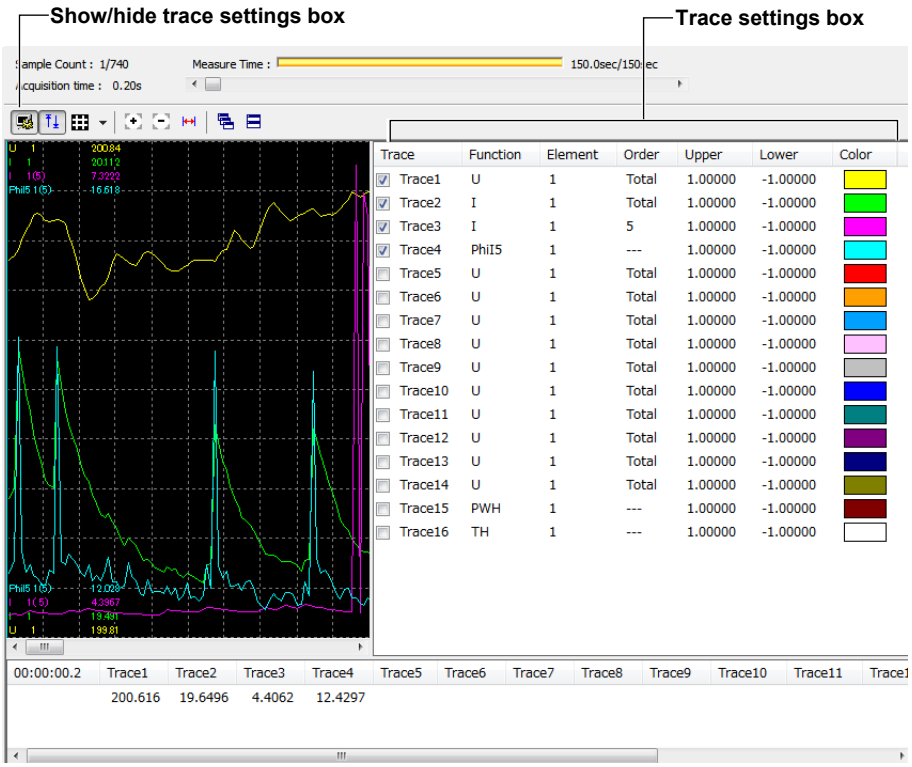
Display range upper limits

Display range lower limits

Cursor (page 9-21).



Configuring Traces



Trace

Select the trends you want to display (select or clear the check boxes).

Function

Select the measurement function to be displayed.

1. Click the **Function** column. A combo box opens.
2. Select the measurement function.

Note

You can select from the following measurement functions.

- U Voltage
- I Current
- P Power
- PhiI5 The phase angle of the 5th order harmonic.
- THC Total harmonic current
- TH THC / I_{ref}
- PWH PWHC /I_{ref}

Element

Select the element to be displayed.

1. Click the **Element** column. A combo box opens.
2. Select the element.

Order

Select the harmonic order that you want to display.

1. Click the **Order** column heading. A dialog box appears.
2. Select the harmonic order you want to display.

Upper and Lower

If the Auto Ranging check box is not selected, set the Upper and Lower limit of the display range.

1. Click the **Upper** or **Lower** column. A combo box opens.
2. Set the upper or lower limit value of the display range.

Color

Select the display color of the trend.

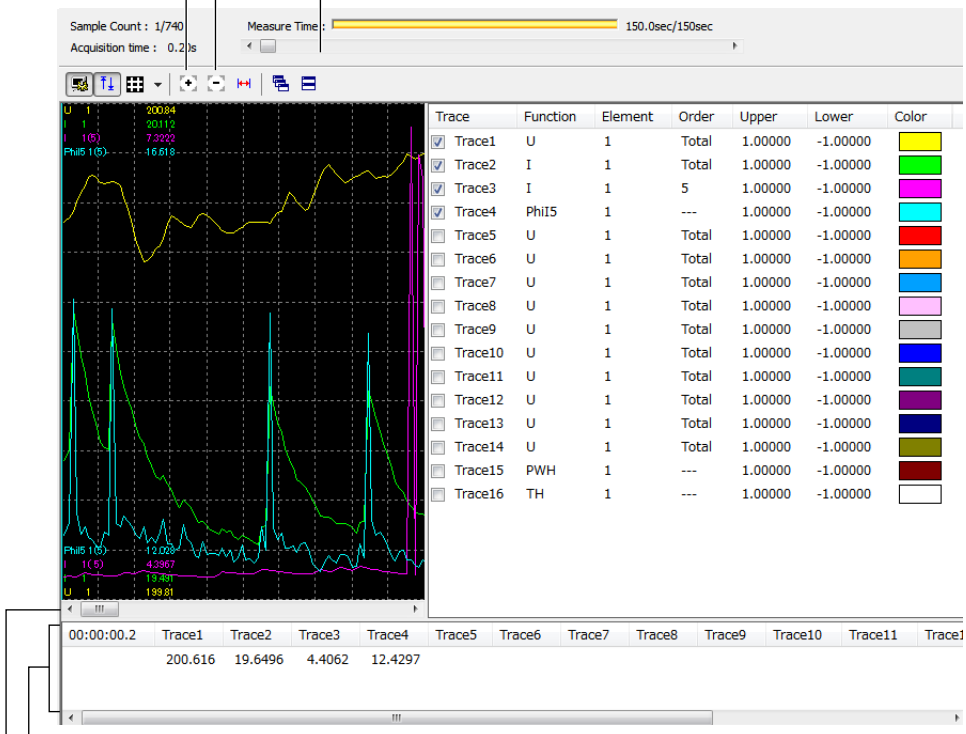
1. Click the **Color** column. A combo box opens.
2. Select the display color of the trend.

Zooming In and Zooming Out

Zoom in
Click to zoom in. You can zoom in until the trend display area contains 2 s worth of data.

Zoom out
Click to zoom out. You can zoom out until the trend display area contains the data for all of the elapsed time.

Scroll bar
You can drag (the slider) with the mouse or click to select the measured data that you want to display.



Cursor
When you click somewhere on the trend display area, a cursor will appear there. You can move the cursor by dragging it.

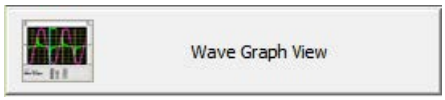
Slider
Move along the time axis to the waveform that you want to display.

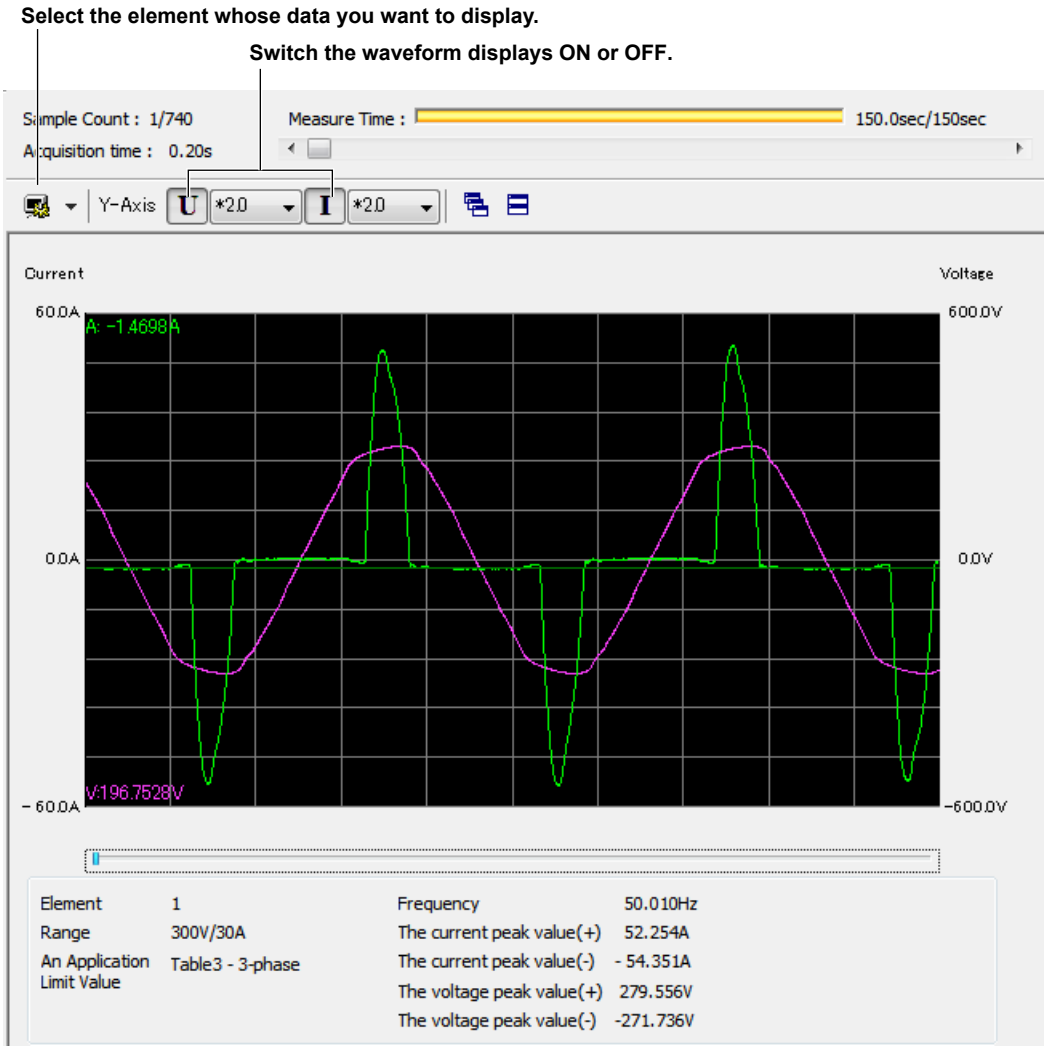
9.7 Displaying a Waveform Graph

1. Select the icon in the menu area. The Analysis submenu appears. For general information about the Analysis submenu, see section 9.1.

Displaying a Waveform Graph

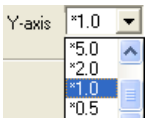
2. Click **Wave Graph View**. A waveform graph appears.





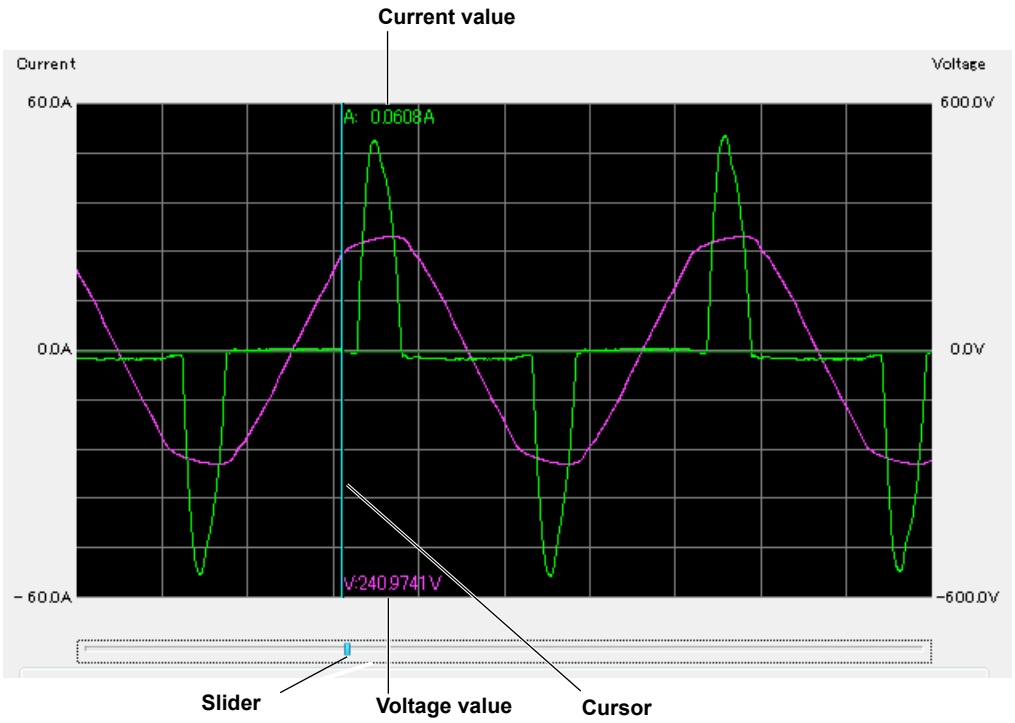
Changing the Y- Axis Scale (the Size of the Voltage and Current Waveforms)

Select ***100.0**, ***10.0**, ***50**, ***2.0**, ***1.0**, ***0.5**, or ***0.1**.



Using the Cursor to Display Current and Phase Angle Values

When you click an area of the waveform, a cursor will appear there. The current and phase angle values at the cursor position will be displayed.



Explanation

The waveform data is acquired immediately after the measurement for a compliance test is finished. The software acquires and displays a waveform graph of about two periods using 2200 points of current and voltage waveform data. You can display waveform graphs for each WT input element. This waveform data is different than the waveform data that is displayed in the waveform preview.

Note

Using the scroll bar will have no effect on the waveform graph display.

Numeric Value Displays below the Graph

- Frequency
  The average value of all frequencies (frequency of the fundamental signal of the PLL source) within the measurement time.

- Current Peak (+)
  Maximum positive value of the current waveform displayed.

- Current Peak (–)
  Maximum negative value of the current waveform displayed.

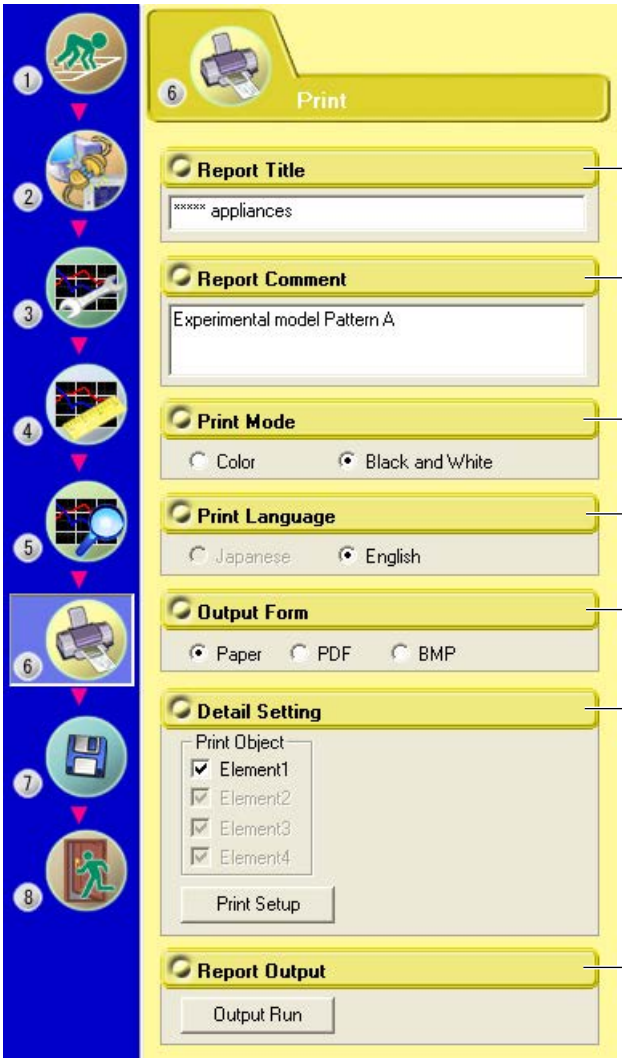
- Voltage Peak (+)
  Maximum positive value of the voltage waveform displayed.

- Voltage Peak (–)
  Maximum negative value of the voltage waveform displayed.

10.1 Setting a Report's Title and Comments

Procedure

1. Select the icon in the menu area. The Print submenu appears.



Enter the report title (page 10-2).

Enter report comments (page 10-2).

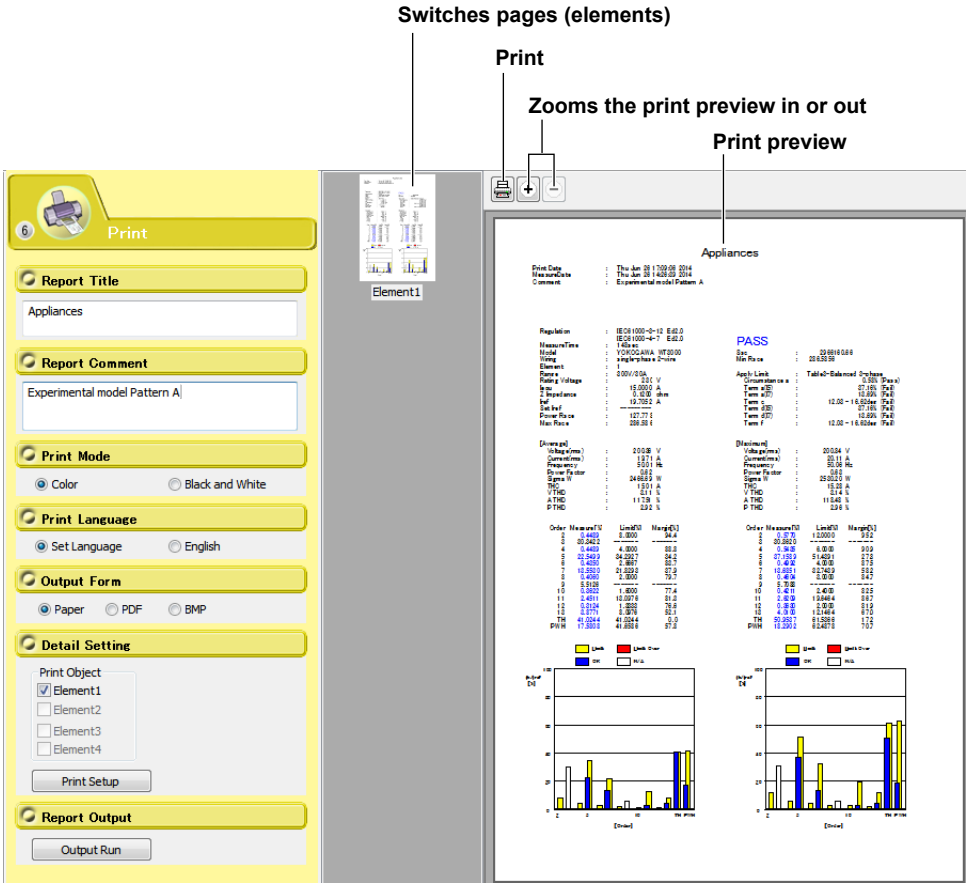
Set the print mode (section 10.2).

Set the print language (section 10.2).

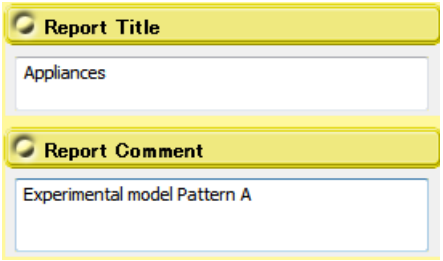
Set the output form (section 10.2).

Set print options (section 10.3).

Print (section 10.4).



2. Enter the report title and the report comments in their respective boxes.



Explanation

You can create reports using the data measured with the software.

Switching the Page to Display a Print Preview Of

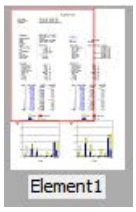
The following pages can be displayed in the print preview.

- Element
- Average (Ave) or Maximum (Max) of each element

* Switching is possible between average and maximum when the apply limit is "Specified condition d,e,f".

Print Preview Display Range

If the print preview is being zoomed in on, the displayed area is indicated with a red frame.



Moving the Print Preview Display Range

Drag the red frame (which indicates the display range) to move the display range.

Setting the Title and Comment of Reports

As necessary, you can set the title and comment of a report.

- **Number of Characters That Can Be Entered**

  See the table below.

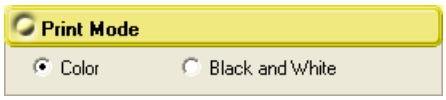
Item	Number of Characters That Can Be Entered
Title	Up to 40 characters can be entered.
Comment	Up to 1000 characters can be entered. Up to 90 characters can be displayed on one line. Up to 6 lines can be displayed.

10.2 Setting the Print Mode, Print Language and Output Form

Procedure

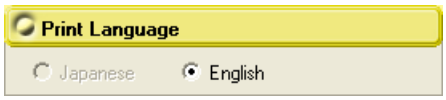
Selecting the Print Mode

1. Select Color or Black and White under Print Mode. When you change the print mode, the print preview in the setting and display area will change accordingly.



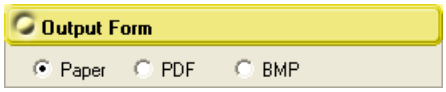
Selecting a Print Language

2. Select English or Japanese under Print Language. When you change the print language, the print preview in the setting and display area will change accordingly.



Selecting a Output Form

3. Select Paper, PDF or BMP under Output Form.

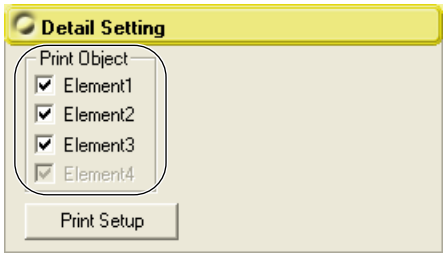


10.3 Setting Print Details (Detail Setting)

Procedure

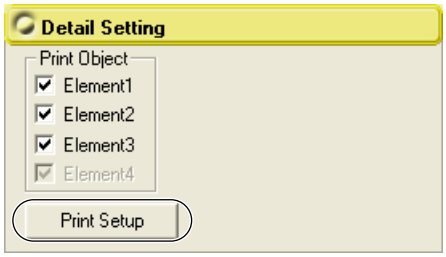
Selecting the Elements Whose Data You Want to Print

1. In the Print Object box, select the elements whose data you want to print.

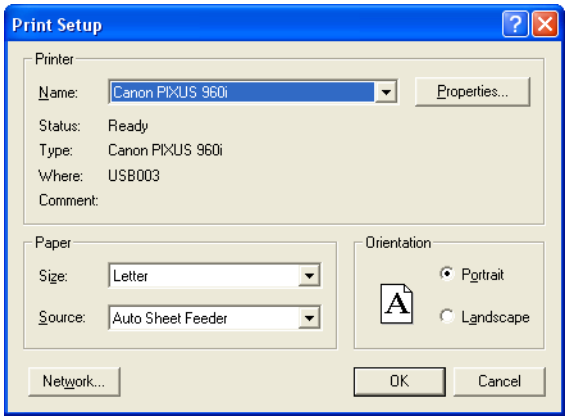


Setting Up the Printer

1. Choose **Print Setup**. The Print Setup dialog box opens.



2. Enter appropriate settings for **Printer**, **Size**, **Source**, and **Orientation**.
3. Click **OK**.



Explanation

Selecting the Elements Whose Data You Want to Print

You can select the elements that were selected under Measure Object. The Measure Object setting is explained in section 7.2.

Print Setup

Make printer settings according to your system environment.

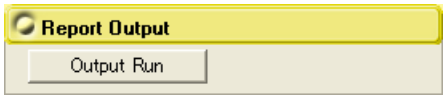
10.4 Printing

Procedure

Printing a Report

You can print a report when measured data has been acquired or has been loaded from memory.

1. Click **Output Run**.
   - If Paper has been selected, proceed to step 2.
   - If PDF or BMP has been selected, proceed to step 3.



2. Enter appropriate settings for **Printer**, **Range**, **Copies**, etc. Click **OK**. The report is printed.

3. Set the **location** and **file name** to save to. Click **Save**. The report is saved in the specified output format (PDF or BMP).

Printing a Report Using the Print Button

1. Click the button. A Print dialog box appears.
2. Enter appropriate settings for **Printer**, **Range**, **Copies**, etc. Click **OK**. The report is printed.

Explanation

Set the printer according to the environment of the system that you are using.

Printing Reports

You can print a report when the measured data has been retrieved (or loaded).
You can print a report for each input element.
When the limits for balanced three-phase equipment under specified conditions (d, e, and f) is specified, the average and maximum values will be printed for each input element.

When the limit is set to fther than "Specified conditions d, e, f"

Appliances

Print Date	:	Thu Jun 26 17:54:12 2014
MeasureDate	:	Thu Jun 26 14:26:39 2014
Comment	:	Experimental model Pattern A

Regulation	:	IEC61000-3-12	Ed2.0
		IEC61000-4-7	Ed2.0
MeasureTime	:	148sec	
Model	:	YOKOGAWA WT3000	
Wiring	:	single-phase 2-wire	
Element	:	1	
Range	:	300V/30A	
Rating Voltage	:	230	V
Iequ	:	15.0000	A
Z Impedance	:	0.1200	ohm
Iref	:	19.7052	A
Set Iref	:	--------	
Power Rsce	:	127.778	
Max Rsce	:	286.586	

PASS

Ssc	:	2966160.66
Min Rsce	:	286.5856
Apply Limit	:	Table3-Balanced 3-phase
Circumstance a	:	0.58% (Pass)
Term a(I5)	:	37.16% (Fail)
Term a(I7)	:	13.69% (Fail)
Term c	:	12.03 - 16.62deg (Fail)
Term d(I5)	:	37.16% (Fail)
Term d(I7)	:	13.69% (Fail)
Term f	:	12.03 - 16.62deg (Fail)

[Average]

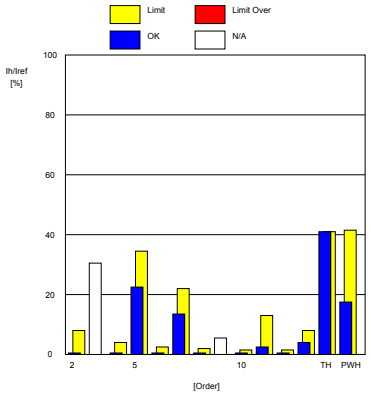
Voltage(rms)	:	200.36	V
Current(rms)	:	19.71	A
Frequency	:	50.01	Hz
Power Factor	:	0.62	
Sigma W	:	2466.69	W
THC	:	15.01	A
V THD	:	3.11	%
A THD	:	117.51	%
P THD	:	2.92	%

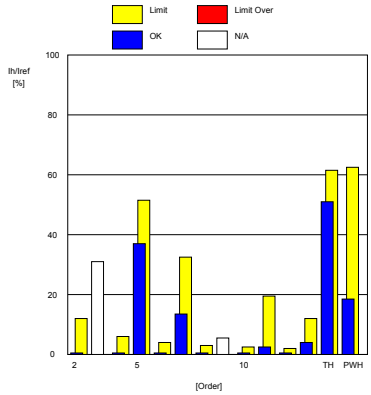
[Maximum]

Voltage(rms)	:	200.84	V
Current(rms)	:	20.11	A
Frequency	:	50.06	Hz
Power Factor	:	0.63	
Sigma W	:	2530.20	W
THC	:	15.28	A
V THD	:	3.14	%
A THD	:	118.48	%
P THD	:	2.96	%

Order	Measure[%]	Limit[%]	Margin[%]
2	0.4489	8.0000	94.4
3	30.3422	-------	-------
4	0.4489	4.0000	88.8
5	22.5499	34.2927	34.2
6	0.4350	2.6667	83.7
7	13.5530	21.8293	37.9
8	0.4060	2.0000	79.7
9	5.5126	-------	-------
10	0.3622	1.6000	77.4
11	2.4511	13.0976	81.3
12	0.3124	1.3333	76.6
13	3.8771	8.0976	52.1
TH	41.0244	41.0244	0.0
PWH	17.5808	41.6586	57.8

Order	Measure[%]	Limit[%]	Margin[%]
2	0.5770	12.0000	95.2
3	30.8620	-------	-------
4	0.5435	6.0000	90.9
5	37.1589	51.4391	27.8
6	0.4992	4.0000	87.5
7	13.6851	32.7439	58.2
8	0.4604	3.0000	84.7
9	5.7088	-------	-------
10	0.4211	2.4000	82.5
11	2.6209	19.6464	86.7
12	0.3630	2.0000	81.9
13	4.0100	12.1464	67.0
TH	50.9537	61.5366	17.2
PWH	18.2902	62.4878	70.7





When the limit is set to fther than "Specified conditions d, e, f" (Average)

Appliances (Average)

Print Date	:	Thu Jun 26 20:00:24 2014
MeasureDate	:	Thu Jun 26 19:51:14 2014
Comment	:	Experimental model Pattern A

Regulation	:	IEC61000-3-12	Ed2.0
		IEC61000-4-7	Ed2.0
MeasureTime	:	148sec	
Model	:	YOKOGAWA WT3000	
Wiring	:	single-phase 2-wire	
Element	:	1	
Range	:	300V/30A	
Rating Voltage	:	230 V	
Iequ	:	15.0000 A	
Z Impedance	:	0.1200 ohm	
Iref	:	19.7052 A	
Set Iref	:	--------	
Power Rsce	:	127.778	
Max Rsce	:	309.420	

FAIL

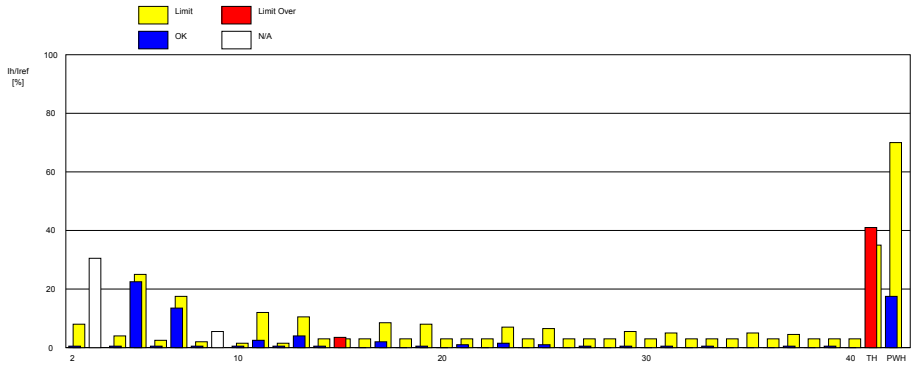
Ssc	:	3202492.08
Min Rsce	:	>= 250.0000
Apply Limit	:	Table5-Balanced 3-phase under specified(d,e,f)
Circumstance a	:	0.58% (Pass)
Term a(I5)	:	37.16% (Fail)
Term a(I7)	:	13.69% (Fail)
Term c	:	12.03 - 16.62deg (Fail)
Term d(I5)	:	37.16% (Fail)
Term d(I7)	:	13.69% (Fail)
Term f	:	12.03 - 16.62deg (Fail)

[Average]

Voltage(rms)	:	200.36 V
Current(rms)	:	19.71 A
Frequency	:	50.01 Hz
Power Factor	:	0.62
Sigma W	:	2466.72 W

THC	:	15.01 A
V THD	:	3.11 %
A THD	:	117.50 %
P THD	:	2.92 %

Order	Measure[%]	Limit[%]	Margin[%]	Order	Measure[%]	Limit[%]	Margin[%]
2	0.4498	8.0000	94.4	3	30.3419	-------	-------
4	0.4495	4.0000	88.8	5	22.5496	25.0000	9.8
6	0.4354	2.6667	83.7	7	13.5528	17.3000	21.7
8	0.4062	2.0000	79.7	9	5.5128	-------	-------
10	0.3624	1.6000	77.4	11	2.4521	12.1000	79.7
12	0.3126	1.3333	76.6	13	3.8776	10.7000	63.8
14	0.2652	3.0000	91.2	15	3.5250	3.0000	-17.5
16	0.2215	3.0000	92.6	17	1.8228	8.4000	78.3
18	0.1839	3.0000	93.9	19	0.4238	7.8000	94.6
20	0.1554	3.0000	94.8	21	1.1497	3.0000	61.7
22	0.1350	3.0000	95.5	23	1.2938	6.8000	81.0
24	0.1187	3.0000	96.0	25	0.8117	6.5000	87.5
26	0.1026	3.0000	96.6	27	0.4435	3.0000	85.2
28	0.0903	3.0000	97.0	29	0.6678	5.4000	87.6
30	0.0821	3.0000	97.3	31	0.7192	5.2000	86.2
32	0.0753	3.0000	97.5	33	0.4240	3.0000	85.9
34	0.0694	3.0000	97.7	35	0.1858	4.9000	96.2
36	0.0629	3.0000	97.9	37	0.4759	4.7000	89.9
38	0.0605	3.0000	98.0	39	0.5101	3.0000	83.0
40	0.0576	3.0000	98.1	TH	41.0241	35.0000	-17.2
PWH	17.5821	70.0000	74.9				



When the limit is set to "Specified conditions d, e, f" (Maximum)

Appliances (Average)

Print Date	:	Thu Jun 26 20:00:14 2014
MeasureDate	:	Thu Jun 26 19:51:14 2014
Comment	:	Experimental model Pattern A

Regulation	:	IEC61000-3-12	Ed2.0
		IEC61000-4-7	Ed2.0
MeasureTime	:	148sec	
Model	:	YOKOGAWA WT3000	
Wiring	:	single-phase 2-wire	
Element	:	1	
Range	:	300V/30A	
Rating Voltage	:	230 V	
Iequ	:	15.0000 A	
Z Impedance	:	0.1200 ohm	
Iref	:	19.7052 A	
Set Iref	:	---------	
Power Rsce	:	127.778	
Max Rsce	:	309.420	

FAIL

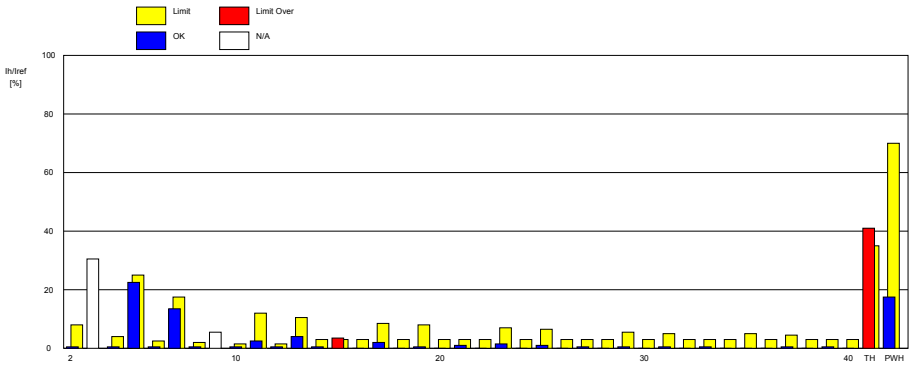
Ssc	:	3202492.08
Min Rsce	:	>= 250.0000
Apply Limit	:	Table5-Balanced 3-phase under specified(d,e,f)
Circumstance a	:	0.58% (Pass)
Term a(I5)	:	37.16% (Fail)
Term a(I7)	:	13.69% (Fail)
Term c	:	12.03 - 16.62deg (Fail)
Term d(I5)	:	37.16% (Fail)
Term d(I7)	:	13.69% (Fail)
Term f	:	12.03 - 16.62deg (Fail)

[Average]

Voltage(rms)	:	200.36	V
Current(rms)	:	19.71	A
Frequency	:	50.01	Hz
Power Factor	:	0.62	
Sigma W	:	2466.72	W

THC	:	15.01	A
V THD	:	3.11	%
A THD	:	117.50	%
P THD	:	2.92	%

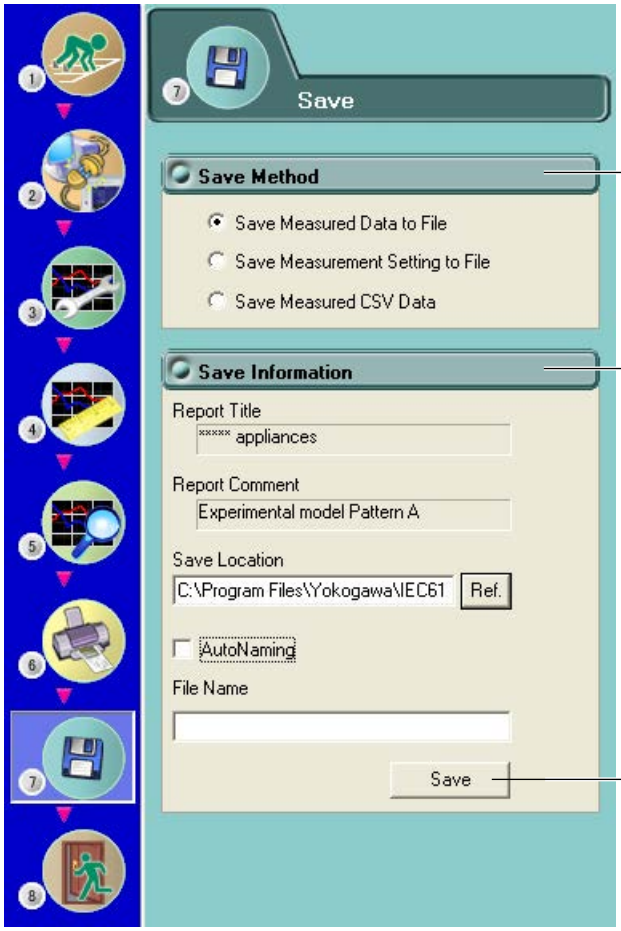
Order	Measure[%]	Limit[%]	Margin[%]	Order	Measure[%]	Limit[%]	Margin[%]
2	0.4498	8.0000	94.4	3	30.3419	-------	-------
4	0.4495	4.0000	88.8	5	22.5496	25.0000	9.8
6	0.4354	2.6667	83.7	7	13.5528	17.3000	21.7
8	0.4062	2.0000	79.7	9	5.5128	-------	-------
10	0.3624	1.6000	77.4	11	2.4521	12.1000	79.7
12	0.3126	1.3333	76.6	13	3.8776	10.7000	63.8
14	0.2652	3.0000	91.2	15	3.5250	3.0000	-17.5
16	0.2215	3.0000	92.6	17	1.8228	8.4000	78.3
18	0.1839	3.0000	93.9	19	0.4238	7.8000	94.6
20	0.1554	3.0000	94.8	21	1.1497	3.0000	61.7
22	0.1350	3.0000	95.5	23	1.2938	6.8000	81.0
24	0.1187	3.0000	96.0	25	0.8117	6.5000	87.5
26	0.1026	3.0000	96.6	27	0.4435	3.0000	85.2
28	0.0903	3.0000	97.0	29	0.6678	5.4000	87.6
30	0.0821	3.0000	97.3	31	0.7192	5.2000	86.2
32	0.0753	3.0000	97.5	33	0.4240	3.0000	85.9
34	0.0694	3.0000	97.7	35	0.1858	4.9000	96.2
36	0.0629	3.0000	97.9	37	0.4759	4.7000	89.9
38	0.0605	3.0000	98.0	39	0.5101	3.0000	83.0
40	0.0576	3.0000	98.1	TH	41.0241	35.0000	-17.2
PWH	17.5821	70.0000	74.9				



11.1 Saving Setting Information and Measured Data

Procedure

1. Select the icon in the menu area. The Save submenu appears.



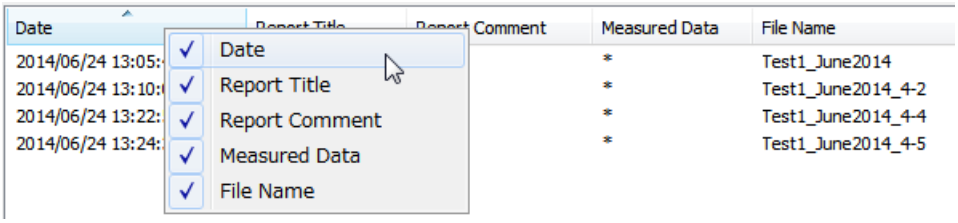
Save Method (page 11-2)
Select the type of data to save and the file format to save it to.

Save Information (page 11-2)
Set the location and file name to save to.

Execute save operation (page 11-2).

Configuring File Information Display Settings

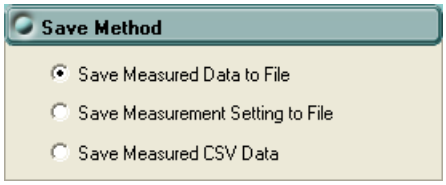
1. Right-click the file information heading area at the top of the setting and display area. A list of the different types of information that can be displayed appears.
2. Select the type of information that you want to display.



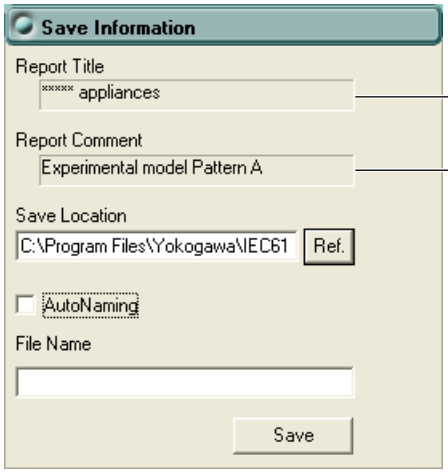
Saving the Measured Data

You can save the measured data when the measured data has been retrieved (or loaded).

1. Click **Save > Save Measured Data**.



2. After selecting a folder in the **Save in** box, enter the name of the file you want to save in the **File name** box.
3. Click **Save** to save the measured data.



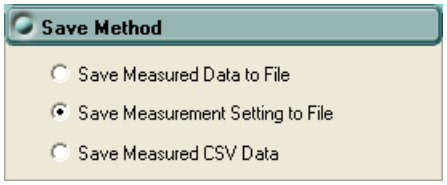
Section 10.1 explains how to set report titles and comments.

Note

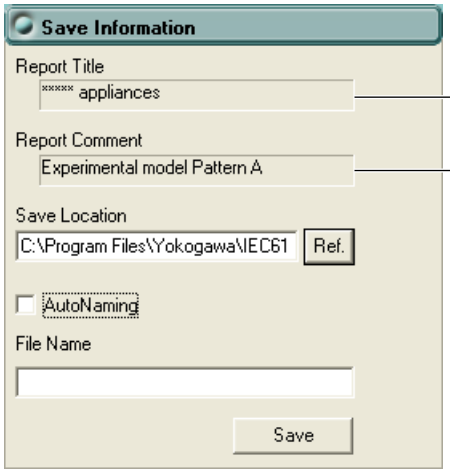
You cannot save the measured data while the measurement is in progress.

Saving the Setting Information

1. Click **Save > Save Setting Information**.



2. After selecting a folder in the **Save in** box, enter the name of the file you want to save in the **File name** box.
3. Click **Save** to save the setting information.



Section 10.1 explains how to set report titles and comments.

Note

You cannot save the setting information while the measurement is in progress.

Explanation

Saving Measured Data

You can use this software to save the harmonic measurement data and waveform data that the PC has acquired from the WT to a file. When the software saves this data, it will also save the WT harmonic measurement conditions along with the setting information.

- An asterisk appears in the Measured Data column of the file information display area.
- The following two types of files are created.
  - fdt Measured data (compliance test data)
  - ini Setting information

File Name/Extension

- You can select any file name that the PC will recognize.

Saving Setting Information

When in online mode, the software can save the following setting information to a file.

- Measurement and judgement conditions (see chapter 7)
- All display settings (see chapters 8 and 9)
- Report titles and comments (see section 10.1)

File Name/Extension

- You can select any file name that the PC will recognize.
- Extension: .ini

11.2 Saving Measured Data in CSV Format

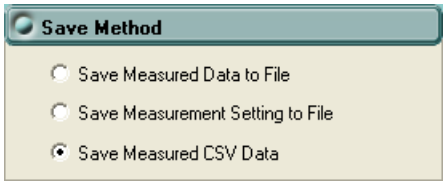
Once the following kinds of data has been acquired or loaded, it can be saved to CSV file format.

- Numeric data
- Waveform data

Note

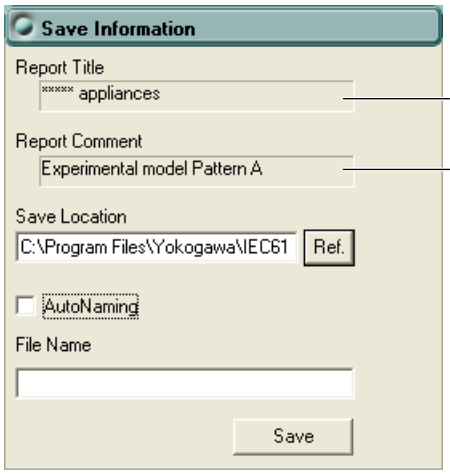
You cannot save measured data in CSV format while measurement is taking place.

1. Select **Save Measured CSV Data**.



2. Specify the **Save Location**, and enter the file name in the File Name box.

3. Click **Save**. The measured data is saved to CSV format.



Section 10.1 explains how to set report titles and comments.

Explanation

You can save data to CSV file format after it has been acquired or loaded. When you save the data in CSV format, you can view it using a PC spreadsheet program (such as Microsoft Excel).

Note

This software cannot load data saved to CSV format.

File Name/Extension

You can select any file name that the PC will recognize.

- Extension: .csv

Data Types

The following data is saved for each measured input element:

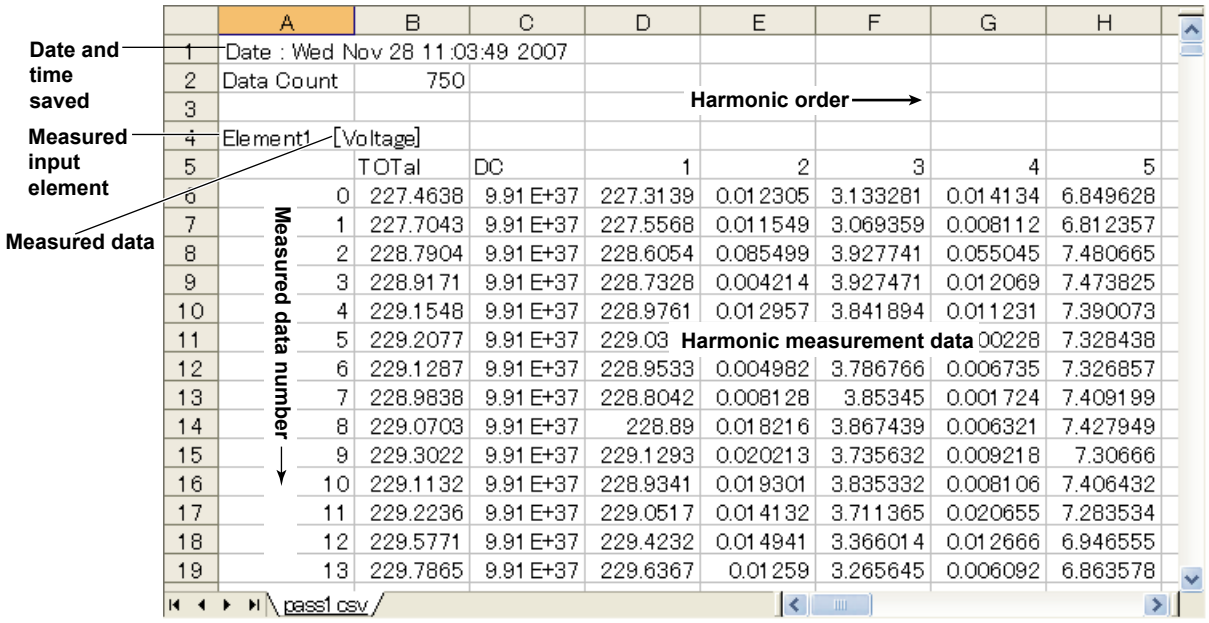
Voltage values
Current values
Active power
Φ (phase angle)
Apparent power
Circuit power factor
FreqXU
FreqXI
Uthd : Voltage THD
THD distortion factor (voltage)
UthdS
Ithd : Current THD
THD distortion factor (current)
IthdS
Distortion factor (P THD)
Phi
FreqU
Thc
Pohc
PhiU1_U2
PhiU1_U3
Voltage waveform data (2200 points)
Current waveform data (2200 points)

Data Size

Under the following circumstances, the software will produce an approximately 6-MB file with about 18000 lines.

- Wiring pattern set to 3P4W 400 V, and the measured input elements set to 1 to 3
- Measurement time set to 2 min 30 s

Example of Numeric Data Saved to CSV Format and Then Opened Using Microsoft Excel



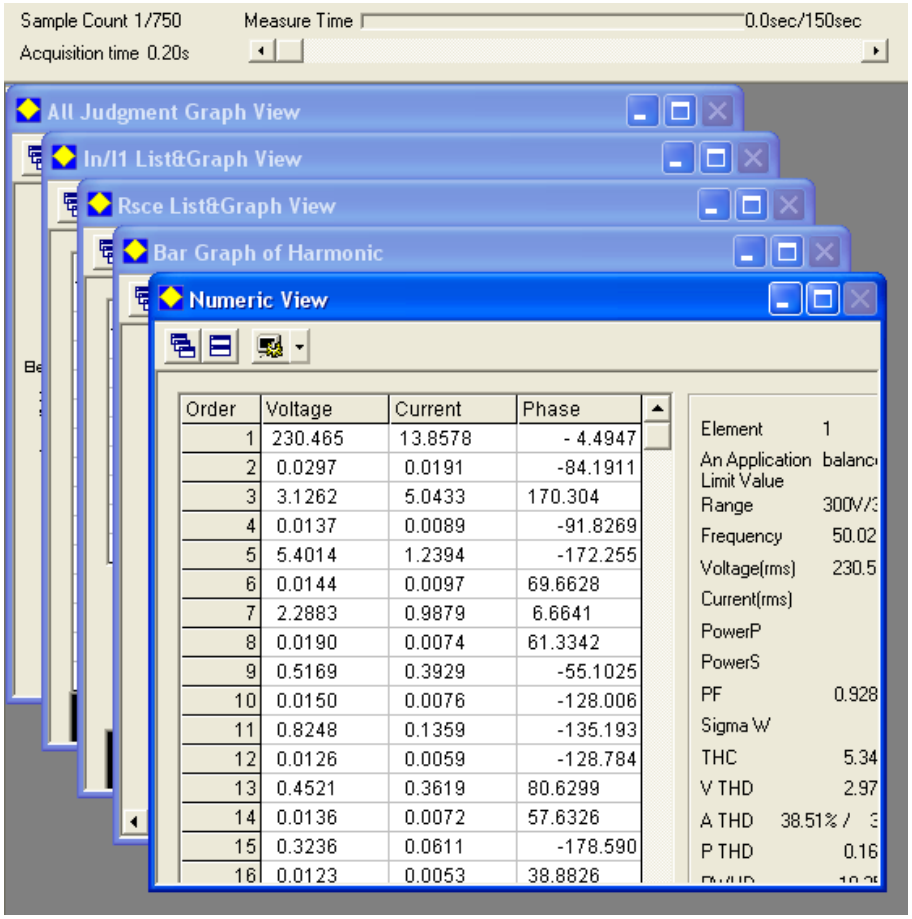
	A	B	C	D	E	F	G	H
1	Date : Wed Nov 28 11:03:49 2007							
2	Data Count	750						
3								
4	Element1	[Voltage]						
5		TOTal	DC	1	2	3	4	5
6	0	227.4638	9.91E+37	227.3139	0.012305	3.133281	0.014134	6.849628
7	1	227.7043	9.91E+37	227.5568	0.011549	3.069359	0.008112	6.812357
8	2	228.7904	9.91E+37	228.6054	0.085499	3.927741	0.055045	7.480665
9	3	228.9171	9.91E+37	228.7328	0.004214	3.927471	0.012069	7.473825
10	4	229.1548	9.91E+37	228.9761	0.012957	3.841894	0.011231	7.390073
11	5	229.2077	9.91E+37	229.03	0.00228	3.786766	0.006735	7.328438
12	6	229.1287	9.91E+37	228.9533	0.004982	3.786766	0.006735	7.326857
13	7	228.9838	9.91E+37	228.8042	0.008128	3.85345	0.001724	7.409199
14	8	229.0703	9.91E+37	228.89	0.018216	3.867439	0.006321	7.427949
15	9	229.3022	9.91E+37	229.1293	0.020213	3.735632	0.009218	7.30666
16	10	229.1132	9.91E+37	228.9341	0.019301	3.835332	0.008106	7.406432
17	11	229.2236	9.91E+37	229.0517	0.014132	3.711365	0.020655	7.283534
18	12	229.5771	9.91E+37	229.4232	0.014941	3.366014	0.012666	6.946555
19	13	229.7865	9.91E+37	229.6367	0.01259	3.265645	0.006092	6.863578

12.1 Cascading Windows

Procedure

Click . The windows are cascaded so that you can see the title of each window.

An Example of Cascaded Windows within the Analysis Window



Explanation

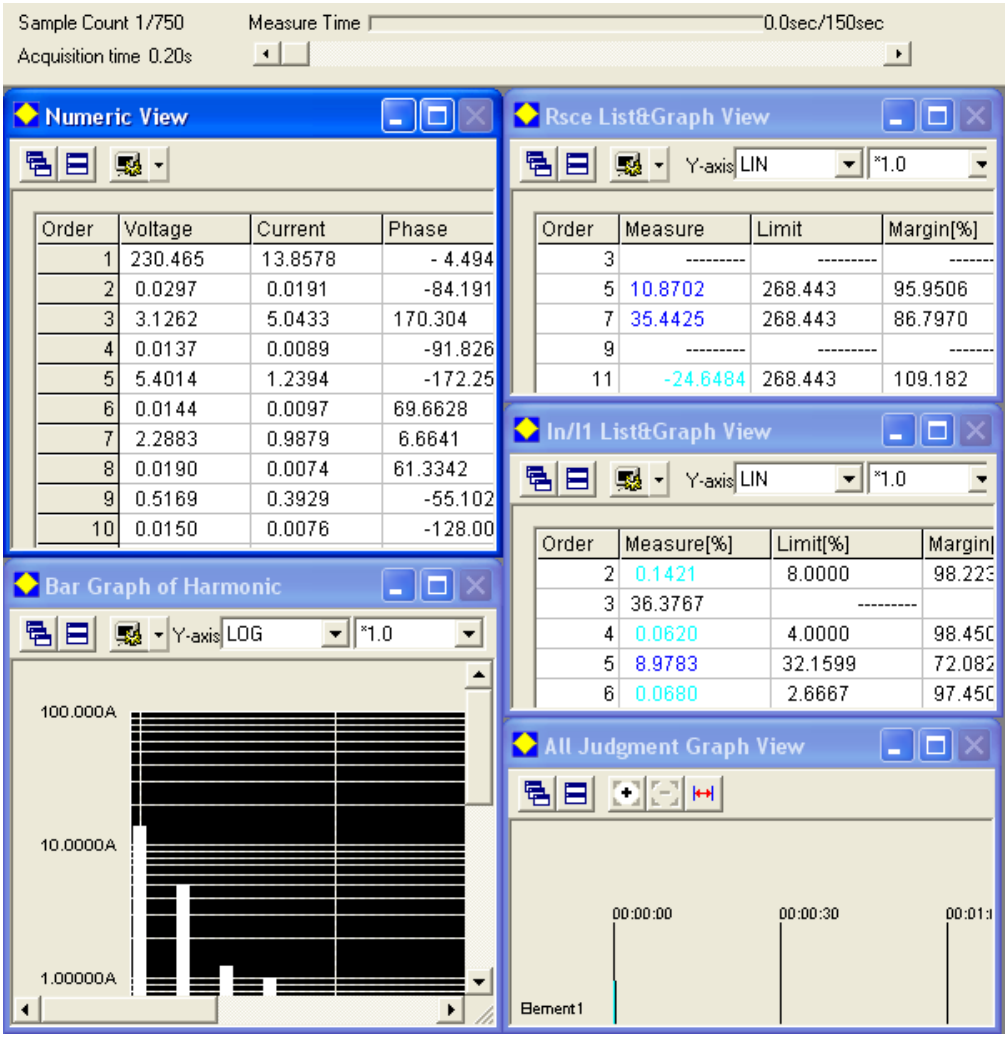
- Windows are cascaded so that the title of all displayed windows can be seen.
- The active graph or list window becomes the front window after the cascade operation.
- The cascade order varies depending on the type of displayed window.

12.2 Tiling Windows

Procedure

Click . The windows are tiled so that they do not overlap with each other.

An Example of Tiled Windows within the Analysis Window



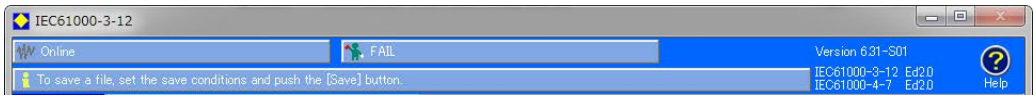
Explanation

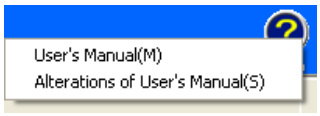
- All the displayed windows are tiled so that the windows do not overlap each other.
- The active graph or list becomes the active window after carrying out the tile operation.
- The arrangement order varies depending on the type of displayed windows.

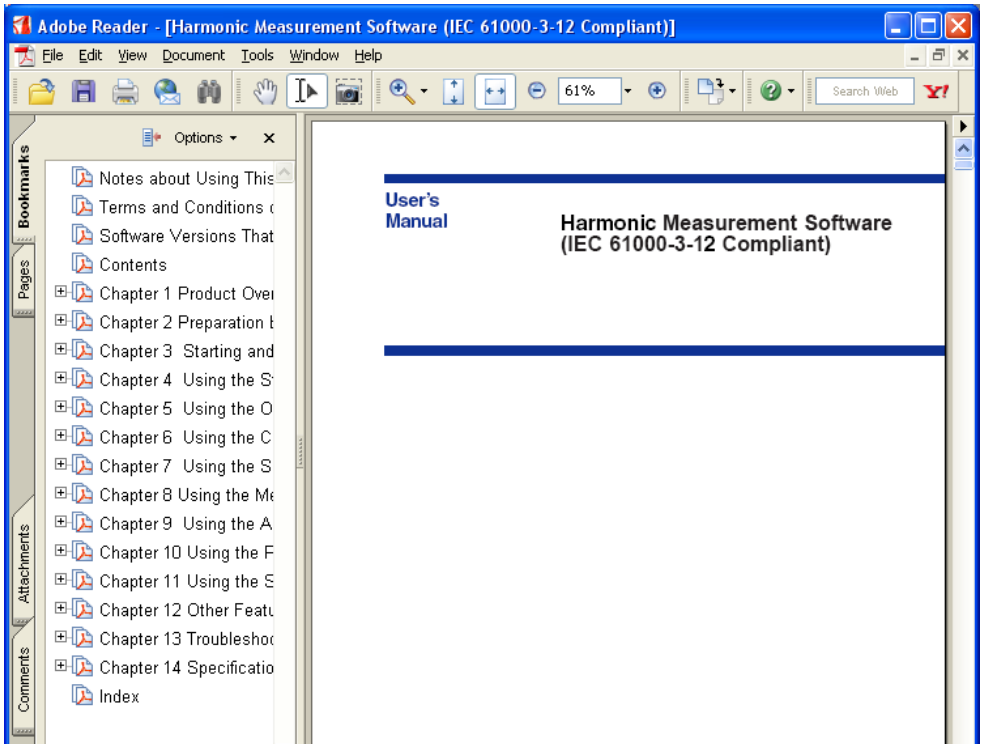
12.3 Using the Help Function

Procedure

Click , the help button. If Adobe Reader is installed on the PC, it will start up and open the PDF User's Manual for this software.







Explanation

Online Help

The user's manual is displayed as a help document in PDF (Portable Document Format). You can find information about operating procedures of this software and terminology. You can view PDF files using Adobe Reader, a freeware.
If there is an alteration notice, you can display it by clicking Help and then clicking **Alterations of User's Manual**. This will open a PDF file of the alteration notice.

Viewing the Most Recent User's Manual or Alteration Notice

To obtain the most recent PDF files of the user's manual and alteration notice, click "Manual Download" on the YOKOGAWA's Web page shown below. Then, download the user's manual and alteration notice of this software program.

http://tmi.yokogawa.com/service-support/downloads/

Rename the downloaded user's manual and alteration notice as indicated below according to the product that you are using, and copy (overwrite) the files in the software installation folder that you specified when you carried out the steps on page 2-8. You will be able to view the most recent operating instructions by selecting the user's manual or alteration notice from the Help menu.

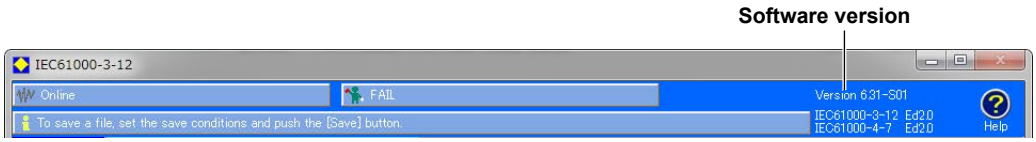
Product	User's Manual File Name	Alteration Notice File Name
WT3000	IM761922-05E.pdf	Alterations-05E.pdf

Note

- You can download Adobe Reader from Adobe System's Web page.
- The most recent user's manual and alteration notice that you can download from YOKOGAWA's Web page correspond to the most recent version of this software program. Update the software program as necessary. The program for updating the software can be downloaded from YOKOGAWA's Web page above.

12.4 Viewing Version Information

The IEC 61000-3-12 Harmonic Measurement Software version number appears in the information area.



Note

- The software version is different for each operation mode indicated below.
  - IEC 61000-3-2 Harmonic Measurement
  - IEC 61000-3-3 Voltage Fluctuation and Flicker Measurement
  - IEC 61000-3-11 Voltage Fluctuation and Flicker Measurement
  - IEC 61000-3-12 Harmonic Measurement

  If any function is updated, the version of the other function may not change.
- For the most recent version of the software, check the YOKOGAWA's Web page below.
  http://tmi.yokogawa.com/products/digital-power-analyzers/
  The program for updating the software as well as the most recent user's manual and alteration notice (see section 12.4) can be downloaded from YOKOGAWA's Web page above.

13.1 Troubleshooting

If a message is displayed on the PC display, see section 13.2, “Error Messages.” If servicing is necessary or if the software is not operating correctly after performing the corrective actions, contact your nearest YOKOGAWA dealer.

Problems and Solutions	
If you cannot connect to the WT3000 via GP-IB:	
	A GP-IB connection made to the WT may not work properly if the GP-IB card that is used is not made by NI (National Instruments). We recommend that you use a National Instruments GP-IB card (see section 1.2).
Measurement stops suddenly.	
	Close the memory-resident software running on the PC. For example, if virus checking software frequently checks the communications between this software and the PC, the performance of the PC may decline drastically. If you choose to stop the virus check and use the PC, please do so in a network environment that is well protected against viruses.

13.2 Error Messages

Message	Corrective Action
Measured data will be initialized. Do you want to execute?	Select OK to initialize the measured data. Otherwise, select Cancel.
Data was lost. Please check your settings and try again.	The communication may be disconnected. Check the cable, noise, etc.
Connection error. Please check your settings and try again.	Check the following items. • The WT is turned ON. • The GP-IB or Ethernet cable is connected properly. • For GP-IB, check that a unique GP-IB address is assigned within the system. Check that the GP-IB address specified on the WT matches the address specified on the software. Check that the GP-IB communication driver is installed correctly in the PC. • For Ethernet, check that the IP address, user name, and password specified on the WT match those specified on the software.
Peak over. Please check your settings and try again.	Check that the voltage or current range is appropriate.
Frequency error. Please check your settings and try again.	Check the frequency and voltage range.
Unrecognized error. Please check your settings and try again.	An unexpected error occurred. Contact your nearest YOKOGAWA dealer.
All the data will be discarded. Do you want to continue?	Select OK to discard the current data. Otherwise, select Cancel.
Write failed.	Check the destination medium. • Check that the storage medium is present. • Check that there is enough free space on the storage medium. • Check that the storage medium is formatted. • Check that the storage medium is not write-protected.
Please input a value from 0.0001 to 99999.9999. Please input a value from 0.01 to 999.99. Please input a value from 1.00 to 99.99. Please input a value from 0.10 to 99.99. Please input value from 0:30 to 15:00. Please input a value from 1 to 99999. Please input a value from 1 to 99. Please input a value from 0.10 to 9.99.	The value you tried to specify is out of range. Set the value within the allowed range.

Specifications

Item	Specification
Software*	Harmonic measurement/judgment software that can measure harmonic currents and judge the results of those measurements based on IEC standards. Displays and prints measurements and judgments. The software's executable file name is IEC61000.exe.
Compatible measurement devices*	WT3000 (Models 760301, 760302, 760303, and 760304)
Applicable standards*	• IEC 61000-3-12: Edition 2.0, Edition 1.0 EN 61000-3-12: 2011: 2005 IEC 61000-4-7: Edition 1.0, Editon 2.0, A1 of Editon 2.0 • EN 61000-3-12 (2005)
Features	Acquisition and loading of measured data and waveform data to be judged. • Configuration of WT measurement conditions • Online acquisition of measured data and waveform data from the WT (online mode) • Loading of previously saved measured data and waveform data (offline mode)
	Measurement modes* • Compliance testing • In online mode Measures the harmonics of the data acquired from the WT, and judges those harmonics based on IEC 61000-3-12. • In offline mode Judges the measured data loaded from a file according to IEC 61000-3-12. • Harmonic preview Only available in online mode. As the WT measures the harmonic current, the harmonic fluctuations appear on a list of measured values. • Waveform preview Only available in online mode. The measured waveform appears as it is measured on the WT.
	Standard and measurement settings Judgment conditions configurable in accordance with IEC 61000-3-12.
	Measurement time The time from the start to the end of measurement. Measurement time can be set in one-second intervals within the range of 0 h 0 min 1 s to 24 h 0 min 0 s.
	Report titles/comments Report titles and comments can be entered. Report formats: color/black and white; English/Japanese. Reports are printed and saved to .bmp or .pdf files along with measured data.
	Measure start/stop Measurement can be started in online mode.
	Display of judgment results, measured data, and waveform data When a compliance test is performed, the software will display judgments as to whether or not the data complies with IEC 61000-3-12, along with the measured data and waveform data that was judged. • Display of all judgment results within the measurement time Determines whether or not all of the data within the measurement time is within the set limits, and displays the result. • I_h/I_{ref} list and graph display Displays the measured values of I_h/I_{ref} for each measured harmonic and the limits set by the standard for those values in both a list and a bar graph. • R_{sce} list and graph display Displays the measured values of R_{sce} for each measured harmonic and the limits set by the standard for those values in both a list and a bar graph. • Bar graph display of harmonic voltage, current, and phase angle Displays the measured data for each harmonic in a color-coded bar graph. • List display of harmonic voltage, current, and phase angle values Displays the measured data for each harmonic in a color-coded list. • Trend graph display Displays a graph that shows data fluctuations over time.

Item	Specification
	• Waveform display of voltage and current Displays a waveform of data measured immediately after the measurement time (displays approximately two waveform periods). • Repeatability of measured data The measured harmonic data values saved in a file are compared against each other, and their differences are displayed in a bar graph and numeric list. Displays whether the differences between the measured data values are within 5% (repeatability), as defined in the standard.
	Loading of measured data, waveform data, and setting information • Loading and saving of setting information Setting information files that contain measurement settings, the measurement time setting, and report titles and comments can be saved. Saved setting information files can be loaded. • Loading and saving of measured data and waveform data Harmonic measurement data and waveform data files can be saved. Measurement settings, the measurement time setting, and report titles and comments are also saved, along with the WT harmonic measurement conditions set using the software. The saved measured data, waveform data, harmonic measurement conditions, and setting information can be loaded. • Saving of measured data and waveform data to CSV format Harmonic measurement data and waveform data can be saved to CSV files. Saved CSV files can be opened with PC programs that support CSV file format.
	Printing and saving of reports Reports can be saved to .pdf or .bmp files. Report files can also be printed.
System requirements	See section 1.2.

* The width of the window function (measurement period) for measurements on the WT3000 is 200 ms (10 cycles at 50 Hz and 12 cycles at 60 Hz) as defined by IEC61000-4-7 Edition 2 or A1 of Editon 2.0.

Compatibility between the WT3000 Precision Power Analyzer and IEC

In the EN61000-3-12:2011 (IEC61000-3-12 Edition 2.0) standard, the requirements for measurement instruments are specified in EN61000-4-7 (IEC61000-4-7).
The WT3000 complies with the items related to EN61000-3-12:2011 (IEC61000-3-12 Edition 2.0) of EN61000-4-7 in the range indicated in the table below.

EN6100-4-7: 2002 (IEC61000-4-7 Editon 2.0: Editon 2.0 + A1: 2002)

Item	EN61000-4-7:2002	WT3000 IEC61000-4-7 Edition 2:2002	Compliance
Current measurement error	5% of the permissible limits or 0.15% Ir of the rated current Ir, whichever is greater	Frequency of the 40th order of the fundamental frequency 60 Hz When the crest factor is 3, 2.5% of reading+0.05% of range → Error within 5% at the limit that is greater than or equal to 2% of the input range When the crest factor is 6, 2.5% of reading+0.1% of range → Error within 5% at the limit that is greater than or equal to 4% of the input range Accuracy at 2.4 kHz (direct input)	Compliant within the range n the left column for direct input
Instrumental loss of the current input circuit	Voltage drop of 0.15 Vrms or less	Instrumental loss Approx. 5.5 mΩ + approx. 0.03 μH	Complies up to approx. 27 Arms
Crest factor of the current input circuit	5 Arms range or less: 4 10 Arms range or less: 3.5 Range above 10 Arms: 2.5 Overload display is necessary.	3 or 6 With overload display	Compliant
Range structure of the current input circuit and withstand overload input	Direct input range: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100A ranges are desirable	0.5, 1, 2, 5, 10, 20, 30 A range (when the crest factor is 3) 0.25, 0.5, 1, 2.5, 5, 10, and 15A range (when the crest factor is 6)	Compliant in the range indicated in the left column. To make accurate measurements, pay attention to the crest factor and range selections.
	External sensor range: 0/1 V to 10 V are adequate.	0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 V (when the crest factor is 3) 0.025, 0.05, 0.1, 0.25, 0.5, 1, 2.5, 5 V (when the crest factor is 6)	
	Excessive input is 1.2 times the range (continuous) and 10 times (1 s)	Direct input Peak value of 90 A or rms value of 33 A, whichever is less (continuous) Peak value of 150 A or rms value of 50 A, whichever is less (1 s) External sensor input Peak value less than or equal to 5 times the range (continuous) Peak value less than or equal to 10 times the range (1 s)	
Anti-aliasing filter	50 dB or higher	50 dB or higher for harmonic components up to the 40th order at the fundamental frequency 50/60 Hz	Compliant
Window function shape	Rectangular	Rectangular	Compliant
Window width	10 cycles (50 Hz)/12 cycles (60 Hz)	10 cycles (50 Hz)/12 cycles (60 Hz)	Compliant
Relative deviation of the sampling frequency and fundamental frequency	Within ±0/03%	Within ±0/03%	Compliant
Grouping of interharmonics	Required	Grouping function available	Compliant
Smoothing	Time constant: 1.5 s	Time constant: 1.5 s	Compliant
Window gap and overlap	No gap and no overlap	No gap and no overlap	Compliant
General specifications	The effects of temperature, humidity, supply voltage, common-mode voltage, static electricity, and electromagnetic field must be specified.	See the items in the general specifications	Compliant in the range of the general specifications

EN6100-4-7: 2002 + A1 : 2009 (IEC61000-4-7 Editon 2.0 : 2002 + A1 : 2008)

Item	EN61000-4-7:2002 +A1:2009 IEC6100-4-7 Editon 2.0:2002 + A1:2008	WT3000	Compliance
Current measurement error	5% of the permissible limits or 0.15% Ir of the rated current Ir, whichever is greater	Frequency of the 40th order of the fundamental frequency 60 Hz When the crest factor is 3, 2.5% of reading+0.05% of range → Error within 5% at the limit that is greater than or equal to 2% of the input range When the crest factor is 6, 2.5% of reading+0.1% of range → Error within 5% at the limit that is greater than or equal to 4% of the input range Accuracy at 2.4 kHz (direct input)	Compliant within the range n the left column for direct input
Instrumental loss of the current input circuit	Voltage drop of 0.15 Vrms or less	Instrumental loss Approx. 5.5 mΩ + approx. 0.03 μH	Complies up to approx. 27 Arms
Crest factor of the current input circuit	5 Arms range or less: 4 10 Arms range or less: 3.5 Range above 10 Arms: 2.5 Overload display is necessary.	3 or 6 With overload display	Compliant
Range structure of the current input circuit and withstand overload input	Direct input range: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100A ranges are desirable	0.5, 1, 2, 5, 10, 20, 30 A range (when the crest factor is 3) 0.25, 0.5, 1, 2.5, 5, 10, and 15A range (when the crest factor is 6)	Compliant in the range indicated in the left column. To make accurate measurements, pay attention to the crest factor and range selections.
	External sensor range: 0/1 V to 10 V are adequate.	0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 V (when the crest factor is 3) 0.025, 0.05, 0.1, 0.25, 0.5, 1, 2.5, 5 V (when the crest factor is 6)	
	Excessive input is 1.2 times the range (continuous) and 10 times (1 s)	Direct input Peak value of 90 A or rms value of 33 A, whichever is less (continuous) Peak value of 150 A or rms value of 50 A, whichever is less (1 s) External sensor input Peak value less than or equal to 5 times the range (continuous) Peak value less than or equal to 10 times the range (1 s)	
Anti-aliasing filter	50 dB or higher	50 dB or higher for harmonic components up to the 40th order at the fundamental frequency 50/60 Hz	Compliant
Window function shape	Rectangular	Rectangular	Compliant
Window width	10 cycles (50 Hz)/12 cycles (60 Hz)	10 cycles (50 Hz)/12 cycles (60 Hz)	Compliant
Relative deviation of the sampling frequency and fundamental frequency	Within ±0/03%	Within ±0/03%	Compliant
Grouping of interharmonics	Required Applies to the second and higher harmonics.	Grouping function available Applies to the second and higher harmonics.	Compliant
Smoothing	Time constant: 1.5 s	Time constant: 1.5 s	Compliant
Window gap and overlap	No gap and no overlap	No gap and no overlap	Compliant
General specifications	The effects of temperature, humidity, supply voltage, common-mode voltage, static electricity, and electromagnetic field must be specified.	See the items in the general specifications	Compliant in the range of the general specifications

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